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PROCEEDINGS  
OF THE  
ROYAL GEOGRAPHICAL SOCIETY.



VOL. XVIII.  
SESSION 1873-74.

Nos. I. to V.

EDITED BY THE ASSISTANT SECRETARY.

*Authors are alone responsible for the contents of their respective statements.*

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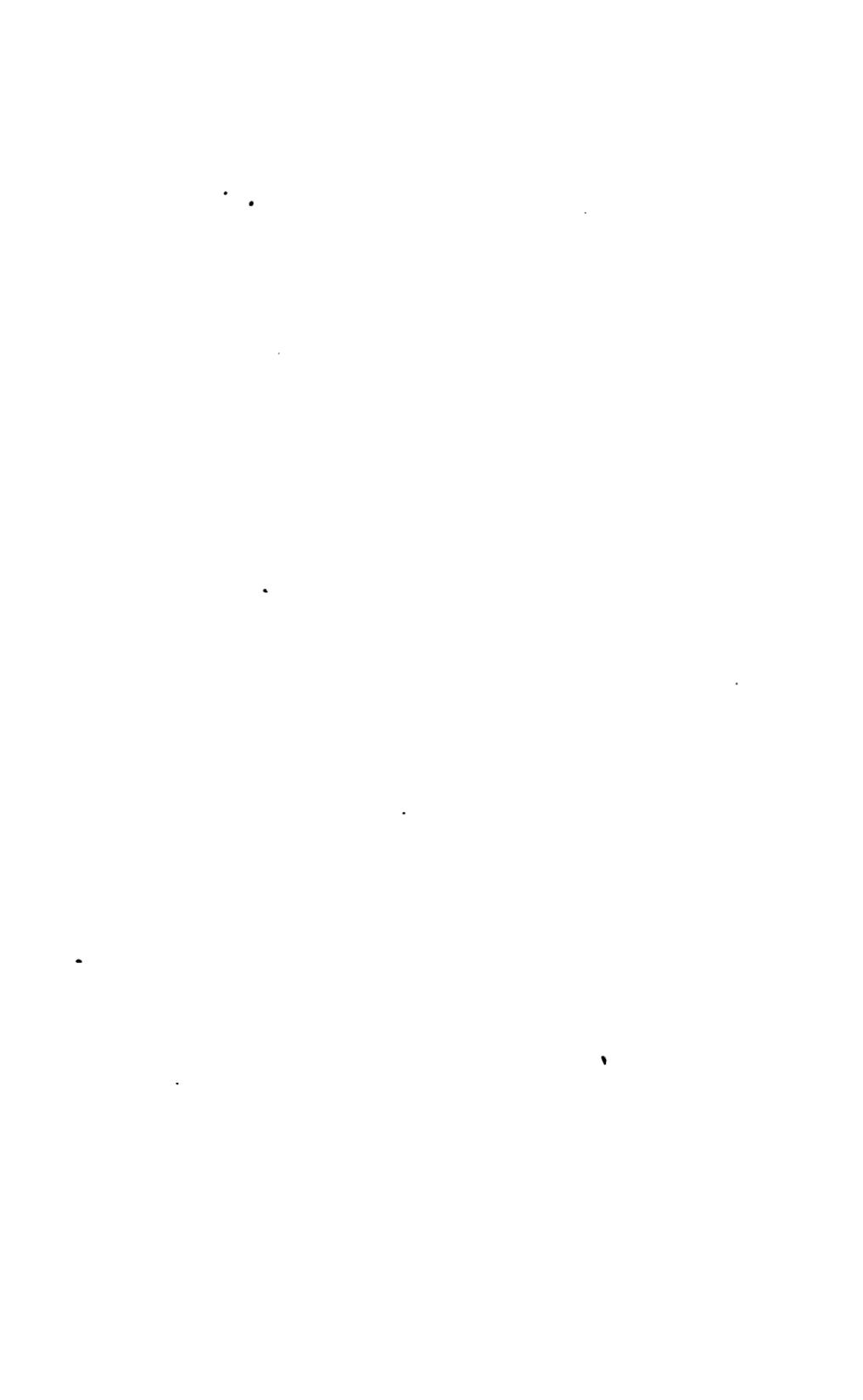
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Every packet must be sent either without a cover, or in a cover open at the ends, so as to admit of the enclosures being removed for examination. For the greater security, however, of the contents, the packets may be tied across with string, but must not be sealed, and should have the words "Book Post" marked in legible characters above the address, in all cases in which there is a postal arrangement for the transmission of printed matter between the two countries at reduced rates.

It is also particularly requested that all MSS. intended for publication in the Society's Transactions be written only on one side, for the convenience of printing.

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PROCEEDINGS  
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SESSION 1873-74.

*First Meeting, November 3rd, 1873.*

SIR H. BARTLE E. FRERE, K.C.B., K.C.S.I., &c., PRESIDENT, in  
the Chair.

ELECTIONS.—*Hugh G. Barclay, Esq.; Lieut.-Gen. Henry Bates; Thomas Thornville Cooper, Esq.; Henry Neville Hart, Esq.; James Hughes, Esq.; W. L. Lawrence, Esq.; General Right Hon. E. Lugard, G.C.B.; Colonel George H. S. Willis, C.B.*

PRESENTATION.—*Charles Whitehead, Esq.*

ACCESSIONS TO THE LIBRARY FROM JULY 7TH TO NOVEMBER 3RD, 1873.—‘Russische Revue fur die Kunde Russlands.’ Von Carl Röttger. Donor the author. ‘Seward’s Travels round the World.’ New York, 1873. By purchase. ‘The Aden Handbook.’ By Captain F. M. Hunter. 1873. Donor the author. ‘Die Preussische Expedition nach Ost-Asien.’ Berlin, 1873. Vol. IV. By purchase. ‘A Voyage to the Isle of France.’ By J. H. de St. Pierre. Donor S. M. Drach. ‘Results of a Tour in Dardistan.’ Vol. I. By Dr. W. Leitner. 1873. Donor the author. ‘Special Report on Immigration.’ By E. Young, PH.D. 1872. Donor the author. ‘Mémoires de l’Académie Royale de Copenhagen.’ Donors the Academy. ‘Abstract of Meteorological Observations made at Calcutta.’ Donors the India Office. ‘Nieuwe Zak-Atlas.’ Voor de Reizigers. Amsterdam, 1739. Donor S. M. Drach. ‘Complete Zak-Atlas van de Zeventien Nederlandsche Provincien.’ Amsterdam, 1786. Donor S. M. Drach. ‘The Eruption of Vesuvius in 1872.’ By Prof. Luigi Palmieri, with Notes by R. Mallet. 1873. By purchase. ‘The English Factory Legislation.’ By E. E. von

Plener. Translated from the German by F. L. Weinmann. 1873. Donor the translator. 'The Social Prospects of the British West Indies.' By W. Walker. 1873. Donor the author. 'On the Social and Economic Position and Prospects of the British West India Possessions.' By W. Walker. 1873. Donor the author. 'Steam Yachts, their Advantages and Disadvantages considered.' Nelson Brothers. 1873. Donors the authors. 'San Juan, Alaska, and the North-West Boundary.' By A. G. Dallas. 1873. Donor the author. 'A few Remarks relative to the Slave-trade on the East Coast of Africa. By Admiral Sir W. H. Hall. Donor the author. 'Catalogue of the Echinodermata of New Zealand, with Diagnoses of the Species.' By F. W. Hutton. New Zealand, 1872. Donor Dr. Hector. 'Baedeker's Handbooks':—for Switzerland (5th Edition); for Northern Germany (5th Edition); The Rhine (5th Edition). Donor the author. 'Itinéraire général de la France.' 2nd Part. Par Adolphe Joanne. Paris, 1865. Donor the author. 'Travels to Tana and Persia.' By Josefa Barbaro and Ambrogio Contarini. Donors the Hakluyt Society. 'Illustrations of China and its People.' Vol. I. By J. Thomson. 1873. Donor the author. 'Costa Rica: its Climate, Constitution, and Resources.' By H. M. Peralta. 1873. Donor the author. 'Remarks on Recent Oceanic Explorations by the British Government by Dr. W. B. Carpenter.' By W. L. Jordan. Buenos Ayres, 1873. Donor the author. 'Le Ultimo Scoperte di Sir Samuele Baker, e del Dottore David Livingstone, sulle Sorgenti del Nilo.' Por Ippolito de Riso. Firenze, 1873. Donor the author. 'La Ferrovia dell' Eufrate.' Por Ippolito de Riso. Firenze, 1873. Donor the author. 'Beiträge zur Entdeckungsgeschichte Afrika's.' Erstes Heft. Von H. Kiepert. Berlin, 1873. Donor the author. 'Über die Lage der Armenischen Hauptstadt Tigranokerta.' Par H. Kiepert. 1873. Donor the author. 'The Franco-German War, 1870-71.' Part I., Section 3. Translated from the German, by Captain F. C. H. Clarke, R.A. London, 1873. Donors the War Office. 'Les Origines du Nil.' Par M. Virlet d'Aoust. Paris, 1872. Donor the author. 'On the Employment of Artillery.' (Translation.) By Lieutenant-Colonel E. M. Reilly, c.b. 1873. Donor the author. 'Les Migrations des Peuples, et particulièrement celle des Touraniens.' Par Ch. E. de Ujfalvy de Mezo-Kovesd. Paris, 1873. By purchase. 'The Armed Strength of Austria.' By Captain W. S. Cooke. Part I. Donors the War Office. 'Letter by Baron Richthofen on the Provinces of Chili, Shansi, Shensi, and Sz-chwan, with Notes on Mongolia, &c.' 1872. Donors the War Office. 'Biographical Sketch of the late Professor Oersted. Copenhagen. Donor W. Brown. 'Geological Evidences

of the Antiquity of Man.' By Sir C. Lyell, Bart. 4th Edition. 1873. 'A Tour up the Straits from Gibraltar to Constantinople.' By Captain Sutherland, 25th Regiment. 1790. Donor S. M. Drach. 'The Threshold of the Unknown Region.' By C. R. Markham, C.B. 1873. By purchase. 'In Memoriam; Alexander Keith Johnston, LL.D., F.R.G.S.' By T. B. Johnston. Edinburgh, 1873. Donor the author. 'Our Meat Supply from Abroad.' By T. J. Hutchinson. Liverpool, 1871. Donor the author. 'The Geology of the Redesdale Iron District.' By G. A. Lebour, F.G.S. Newcastle-upon-Tyne, 1873. Donor the author. 'Report on the Fresh-water Fish and Fisheries of India and Burma.' By Surgeon-Major F. Day. Donor the author. 'Esploracion de las Costas de Colchagua i de Curicó i de la Albufera de Vichuquén.' Santiago, 1873. 'Esploracion del Seno de Reloncavi, Lago de Llanquihue i Rio Puelo.' Por F. V. Gormaz. Santiago, 1872. 'Esploracion de la Costa de Llanquihue i Archipiélago de Chiloe.' Por F. V. Gormaz. Santiago, 1871. 'Reconocimientos de la Costa comprendida entre la Rada de los Vilos i el Rio Choapa i entre el Morro Bonifacio i el Rio Maullin.' Por F. V. Gormaz. 'Continuacion de los Trabajos de Esploracion del Rio Valdivia i sus Afuentes.' Por Capitan F. V. Gormaz. Santiago, 1869. 'Conclusion de la Memoria de Marina de 1872.' Santiago, 1872. 'Memoria que el Ministro de Estado en el Departamento de Marina presenta al Congreso Nacional de 1872.' Santiago. Donor E. C. Reed, Esq. 'New Zealand.' By A. Kennedy. London, 1873. Donor the author. 'A Précis of Modern Tactics.' By Major Robert Home, R.E. Donor the author. 'To the English-Speaking Populations in Europe, Asia, Africa, Australia, and Polynesia, as a Token of Appreciation of their Language.' By J. A. Weisse, M.D. New York, 1873. Donor the author.

ACCESSIONS TO THE MAP-ROOM SINCE THE LAST MEETING OF JULY 7TH, 1873.—The Accessions to the Map-room since July 7th to the present time have been 172 Maps, on 397 sheets, of which the following are the principal:—A Map of Kokan and the Upper Basin of the Amu Daria. In Russian characters. Presented through the Assistant-Secretary. A Chart of the Eastern Coast of the Caspian Sea towards Khiva; published by the Imperial Russian Geographical Society. In Russian characters. French Hydrographic Annals and Pilot-books: 8 Maps. Presented by the Dépôt de la Marine, Paris. Topographical Map of Central California. By J. D. Whitney, &c., State Geologist; also a Map of the Bay of San Francisco. Presented by J. D. Whitney, Esq., State Geological Surveyor. 8 Geological Maps of Norway and Sweden.

By purchase from C. E. Fritze of Stockholm. Central Asia.—Great Trigonometrical Survey of India; Route from Badakshan across the Pamir Steppe to Kashgar, &c. Presented by Major Montgomerie, R.E., F.R.G.S. Maps of Hesse Darmstadt: 4 Maps, on 30 sheets. Purchased from the Hessian General Staff. United States.—6 Maps of various parts of the Western Territory, Dakota, &c., &c. Presented by the Office of the Chief Engineer, Washington. Africa, South-East.—Gaza Country, showing the Route of Mr. St. V. Erskine from Natal to Umzila. Presented by St. V. Erskine, Esq. India.—58 Maps, on 180 sheets, of various parts of India. Presented by Her Majesty's Secretary of State for India through the India Office. New Guinea.—Chart of a running Survey made by Captain J. Moresby and Naval Lieutenant J. L. Mourilyan, of H.M.S. *Basilisk*. Presented by Captain J. Moresby through the Hydrographic Office. Africa, West.—Map of the Ashantee Country and the Gold Coast. Presented by Major C. W. Wilson, R.E., Topographical Depôt of the War Office. Sweden.—Plan of the City of Stockholm. By C. E. Duhrman. By purchase. Atlases:—Spruner's Hand-Atlas, Parts 7, 8, 9, containing 12 Maps; Stieler's Hand-Atlas, Parts 11 to 18, containing 18 Maps. Presented by Justus Perthes of Gotha. America, South.—Provinces of Cordoba, Buenos Ayres, &c., &c.; viz., 4 Maps, on 16 sheets. Presented by Don Saturnino Salas. India.—Topographical Maps of various parts, on 16 Maps of 53 sheets. Presented by Her Majesty's Secretary of State for India through the India Office. Admiralty Charts. 44 on 50 sheets. Presented by Admiral G. H. Richards, C.B., through the Hydrographic Office.

The PRESIDENT opened the business of the Session with the following Address:—

Before we proceed to any other subject, I feel sure that the Fellows of the Royal Geographical Society will be most anxious to hear the latest news of their valued Associate, Sir Samuel Baker, whom we hoped to have had among us on this occasion.

In reply to my note welcoming him to England, and expressing the anxiety which I was sure would be felt by every member of the Society to meet him as soon as possible after his return, Sir Samuel Baker wrote as follows:—"On the 10th November we are engaged in the country, and shall be so all through November. The special meeting on 3rd November will be most convenient, and I shall look forward with great pleasure to attending it. The geographical part of my expedition has been meagre, as I have been so entirely engaged in establishing the government throughout the large ter-

ritory annexed. The suppression of the slave trade, sometimes by force at other times by diplomacy, has been an arduous and thankless task, as it is not appreciated in Egypt. This was my chief object in the Expedition. The Geographical Reports respecting a communication between the lakes were to me of great interest. There can be no doubt that Livingstone is quite out of the Nile basin, as there is not a single large tributary from the west throughout the entire course of the Nile."

It was with very sincere regret that I received, subsequent to this, a note from Lady Baker, dated the 23rd October, in which she said, "I grieve to tell you that Sir Samuel Baker is laid up with an attack of inflammation of the lungs, which has made us very anxious. It would be quite impossible for him to think of being present at the Geographical meeting on the 3rd. If you should think of postponing it, I would write again in a few days, when I should be better able to give you an idea of when he would be well enough to come up to town. At present he is very weakend and too ill to think of any engagements."

Since then we have received accounts of his continued amendment, and he has every hope of being present at your meeting, fixed for the 8th December next.

I must not omit to mention a circumstance which I am sure will give great pleasure to every Fellow of the Royal Geographical Society. I felt it my duty to communicate to His Royal Highness the Prince of Wales, the Vice-Patron of the Society, through his private Secretary, the arrangements of the meetings for the Session. I mentioned the date on which we hoped to have the pleasure of welcoming Sir Samuel Baker's return among his old Associates, and I ventured to express the gratification which I felt sure it would afford the Fellows of the Society if His Royal Highness should see fit to honour one of our meetings with his presence.

In reply I received from Mr. Knollys the following notes, dated Marlborough House, 25th October, 1873:—

"The Prince of Wales desires me to thank you very much for your information respecting the meetings of the Geographical Society, and also for your account of Sir Samuel Baker's illness, which he is, I need hardly assure you, most concerned to hear of.

"Should his engagements allow of it, His Royal Highness would derive much gratification from being present on the evening when Sir Samuel gives his lecture, and I should be greatly obliged if you would kindly let me know the day as soon as it is fixed.

"When you have an opportunity perhaps you will have the goodness to make Sir Samuel acquainted with the sincere regret which

the Prince experiences at hearing of his illness, and of his hope that he may be soon restored to health."

(*Same date.*)

"Since I wrote you the accompanying note, I have received the Prince of Wales' instructions to state that he is most anxious to be present when Sir S. Baker is received, for the first time since his return, by the members of the Royal Geographical Society, and that he would suggest whether it would not be possible that that ceremony should take place on Monday, 8th December.

"His Royal Highness names that day, as owing to his absence from England in January and February, and to other causes, he is afraid it will be the only occasion on which it would be in his power to be present at any of the meetings before the spring, and as His Royal Highness has shown so great an interest in the success of Sir S. Baker's Expedition, it would be a source of considerable disappointment to him were he to be absent when Sir Samuel first presents himself to the Society in question.

"I am, &c.,

"FRANCIS KNOLLYS."

I feel sure that, great as is the importance of African discovery, *per se*, the Fellows of the Royal Geographical Society feel, if possible, even greater interest in the personal welfare of our illustrious Associate, Dr. Livingstone, and they will have weighed with all the attention due to them Sir S. Baker's opinion that he is already out of the Nile Basin, and also the intelligence communicated to the public by Dr. Beke through the 'Times' on the 1st November, on the authority of a correspondent in Portuguese Congo, that Living stone was then within twenty days' march of the writer, and only detained by the want of means to pay a ransom, which had been already sent to him.

We have been so often alternately dismayed and disappointed by reports of this kind, that we must await further intelligence before believing in the possibility of welcoming Livingstone back in the course of a couple of months. There is, of course, no inherent impossibility in the report which need prevent our hoping it may be true; and if Livingstone is, in this way, out of the Nile Basin, we may safely say that, whether he may show that he has passed from one great river-basin into another—from that of the Nile into that of the Congo—or that both basins are connected, and that the rivers have in fact but one basin, as the old geographers described them, even he, in the course of all his travels, has never accomplished a

more arduous feat, or established a more important geographical fact.

It is usual, on our reassembling at the commencement of each annual Session, for the President to say a few words descriptive of the course of geographical inquiry during the recess, and briefly to indicate the course which may be expected to be taken by the Society in bringing forward papers for the consideration of the Fellows.

Sir Rutherford Alcock, one of our Vice-Presidents, in presiding over the Geographical Section of the British Association, assembled at Bradford in September, not only supplied us with a very valuable *résumé* of Geographical inquiry since my predecessor Sir Henry Rawlinson's Annual Address in May last, but has furnished us with an original contribution to Geography, such as might be expected from one who has filled such a prominent and distinguished place as a diplomatist in countries of so much geographical importance as Japan and China. I would commend Sir Rutherford's Address to the careful perusal of all who are interested in those practical results of geographical inquiry which affect international politics and diplomacy. I propose to refer more particularly to other portions of his Address, and to some of the papers which were read before his Section, when I request your attention to the separate branches of geographical inquiry which are likely to occupy us during the coming season.

I know of no subject which is likely to have greater interest for the Royal Geographical Society of England than questions of Arctic discovery, and here we have some very important facts which have been brought to light since the close of last Session. Captain Markham, R.N., indicated some of these facts in what he stated to the Geographical Section of the British Association, and a fuller account will be given you this evening by our Secretary, Mr. Clements Markham, in the paper which he has drawn up on the voyage of his relative to Baffin's Bay, and on the facts regarding the discoveries of the *Polaris* which he was able to obtain. I will not anticipate what will be read to you by Mr. Markham and said by the veteran Arctic explorers who may address you this evening. I will only ask you to weigh well the very strong evidence afforded by the voyage of the *Polaris* as to the soundness of what was previously an hypothesis, viz., the existence of an open-water channel leading northwards from Smith's Sound; which channel—it may be from permanent causes, it may be from some temporary variety in the seasons—is now more free from ice than at any previous period of which we have knowledge.

I would also draw your special attention to the opinion of Captain Markham, himself an experienced navigator, as to the extraordinary facilities afforded by a steam-vessel of the class of the *Arctic*, in which he sailed, for conducting Arctic exploration.

Facts like these can hardly be submitted to a company of geographers without suggesting the idea of further expeditions with a view to set at rest questions which have occupied the attention of navigators since the days of Queen Elizabeth. The Royal Geographical Society has always taken a prominent part in the advocacy of such expeditions, and there is hardly a name of note among the Arctic voyagers of modern days which is not to be found among the Fellows of the Society. The subject would certainly command the most anxious attention of the Council, and I would only state, as my own personal conviction in the matter, that we ought if possible to secure the concurrence and support of Government in anything which may be undertaken. For scientific inquiry the public might safely trust to the Royal Society, and to our own Society, which has always taken a warm interest in the subject. But Arctic enterprises are always of a character to task to the utmost the highest qualities of British ships as well as British seamen; and I am convinced you would all feel much greater confidence in seeing our own countrymen undertake the perils of such an expedition, if we were assured that they carried with them not only all that British private enterprise could secure, but all the experience and all the discipline which are found in the highest perfection in the ranks of the Royal Navy.

In respect to China, the papers of Mr. Ney Elias and Baron von Richthofen are of the highest importance. The Baron's account of the geology, and especially the coal-fields of China, is little less than a revelation of new scientific truth from a quarter which we have been in the habit of considering as likely to interest us more through the antiquities of civilisation than the novelties of natural science. I am glad to be able to state that Baron von Richthofen has promised us a paper for the present Session on the general subject of the Physical Geography of this great country.

A great mass of information regarding the countries westward of China, and extending to the frontiers of the Russian and Turkish empires, will be found in the papers which were read before the British Association by Sir Frederick Goldsmid, Mr. Blandford, Major St. John, and Major Euan Smith. The interest of this part of the world is not likely to be diminished by the Russian Expedition to Khiva, and it is clear that no impassable barrier will now separate the observations of our trigonometrical surveyors in India

from those of their Russian fellow-labourers in Siberia, nor will any barbarous interval form a break between the trade-routes of India and Southern Asia, and those of the Caspian Basin and Tartary.

Another group of papers regarding New Guinea and the adjacent islands proves that the curtain is now lifting which has so long concealed from the attention of Western geographers the vast resources and capabilities of the southern portion of the Great Indian Archipelago. Whether regarded as contributions to physical geography, or to ethnology, or as indications of further information which is likely to be afforded at no distant date, the papers of Captain Moresby and the Rev. Mr. Gill are of great interest. Both these papers having been presented by their authors to our Society, and read only in abstract at Bradford, will form, I may announce, the subjects of one of our evening meetings in the course of the present Session.

Regarding Eastern and Central Africa a considerable amount of miscellaneous information has been collected, which will fill up gaps, and doubtless lead to further inquiry regarding the eastern coast of Africa. The Society will be glad to hear that, though we have no further news of Dr. Livingstone, our latest accounts of both the expeditions sent out in the hopes of meeting him tell of satisfactory progress. You will remember that two expeditions left England for this purpose: one proceeding from the Portuguese possessions on the west coast, up the River Congo, under Lieutenant Grandy, R.N., the expenses being defrayed by Livingstone's noble-minded friend, Mr. J. Young, of Kelly. Our latest direct accounts of this expedition are communicated by Mr. Robert Scott Newton, Vice-Consul at Loanda, in South-West Africa. He left Loanda on the 24th July, and states that the Governor-General had just received a letter from the King of the Congo that the expedition had left San Salvador, the furthest point in the Portuguese dominions, about the 16th June, in good health; so that we may any day hope to hear of their further progress in their search for tidings of Livingstone; and every step will add to our knowledge of this most interesting, but little known, region. Comparing Mr. Newton's dates with those of Dr. Beke's Portuguese informant, published in the 'Times' of Saturday last, I think that we must await some confirmation of the latter report before concluding that Lieutenant Grandy had turned back.

The other expedition, as you are aware, started under Lieutenant Cameron from the east coast, and they encountered a variety of delays and disappointments, and sustained a serious loss in the death of Mr. Moffat, the youngest, but not the least promising,

Besides the subjects already mentioned, I am glad to say that many other papers are in hand, on various countries, and will be brought before you in the course of the Session. Among them are one on the late Captain Rokeby's Surveys in Nubia, between Suakin and Berber; one by Dr. Kirk, on his Examination, in company with Captain Wharton, R.N., of the Mouth of the Lufiji River—the interesting stream on the East Coast of Africa, of which we still know so little; a third by Professor Leone Levi, on the Geography and Resources of Paraguay; besides others on Australia, Persia, and Beluchistan.

In conclusion, I cannot refrain from alluding to the great losses which Geographical Science, and our Society in particular, have sustained during the vacation, in the death of so many distinguished travellers:—Count de Strzelecki, Admiral Sir Robert McClure, Mr. Emil von Sydow, Sir Henry Holland, Mr. J. B. Pentland, the explorer of Southern Peru and Bolivia. This is a heavy list in so short a period. I do not record the names here with the intention of drawing attention to the great services which each has rendered to Geography and the kindred sciences; this, indeed, would be to anticipate the obituary notices which form part of the Annual Address in May of each year, and the drawing up of which will be part of my duty. But, as veteran travellers and geographers disappear from the scene, I would ask the younger members of the Society to remember that the Royal Geographical Society cannot afford to rest its character merely on the laurels of a bygone day; and that, if the Society would keep its position before the world, young and able geographers must not rest whilst there remain regions on the earth's surface with the physical features or inhabitants of which our countrymen are still imperfectly acquainted.

The following paper was read:—

*The Discoveries of the 'Polaris,' and Voyage of the 'Arctic.'*

By C. R. MARKHAM, Esq., C.B., Secretary R.G.S.

COMMANDER MARKHAM was appointed to the *Sultan* before he had been three weeks in England (after returning from the Arctic regions), and is now on his way to Lisbon; so that the results of his observations must be presented to the Society without the advantage of his presence, and in a paper, the contents of which are culled from his journal, and from his Report to Admiral S. Osborn, but not by himself. His own experience of ice navigation, and the details he gathered from the crew of the *Polaris*, are, however, so

important that it has been thought desirable to bring them before a meeting of the Society thus early in the Session, in order that the Fellows may be in possession of the new data relating to the problem of Arctic exploration. In the present very brief communication the chief points of interest connected with the discoveries of the *Polaris* will be enumerated, and the experience acquired from a modern voyage in a powerful steam-whaler, as regards ice navigation, will be pointed out.

It must be remembered, in the first place, when we consider the remarkable character of Captain Hall's voyage, that his vessel was ill adapted for the purpose, and had insufficient steam-power; that the commander was a man without education, and that he was in no sense a seaman, but rather an enthusiastic and most gallant leader, depending on others to navigate his vessel and to render his discoveries useful; and that the officers and crew were for the most part advanced in years, of various nationalities, without any zeal for discovery, without discipline or control, and in a position in which every man considered himself as good as his neighbour. Mr. Hall himself, and Dr. Bessels, were the only two among the ill-assorted company who were really interested in the work. It is necessary to dwell upon this aspect of the question, to show how much, how very much might be done, under the same circumstances, by a really well-equipped naval expedition.

The most striking fact connected with the voyage of the *Polaris*, in August 1871, is that she went from Cape Shackleton to her extreme northern point up Smith Sound, in  $82^{\circ} 16' N.$ , in five days, without obstruction of any kind; and that even then she was stopped merely by loose floes, through which a powerful vessel, like any one of the Dundee whalers, could easily have forced a passage. Indeed, Captain Markham was informed that the *Polaris* was stopped by a very insignificant stream of ice, with a magnificent water sky as far as could be seen to the northward. Hall himself was most reluctant to turn back; but, being no sailor, and having no experience in ice navigation, he thought he had no alternative but to follow the advice of old Captain Buddington, who had no interest in the matter, and feared that if they persevered it might be difficult to retrace their steps.

The floes up Smith Sound were not of a heavy description, and seldom exceeded five feet in thickness, so that we may infer that they were formed in one winter. No icebergs of any size were seen to the north of  $80^{\circ}$ . But there is one very remarkable point connected with the ice-drift. At Newman Bay, about 18 miles to the northward of the winter quarters of the *Polaris*, in  $81^{\circ} 38' N.$ ,

the floes appeared to be heavier and more extensive than they were to the southward, although they were all drifting to the south and west. Two or three of the fields off Newman Bay were estimated to be a mile long and of considerable thickness; but all the ice seen from their winter quarters appeared to be only of one year's growth. Dr. Bessels believes the opening called Lady Franklin's Bay to be a strait, and he accounts for the disappearance of the heavy ice to the south of about  $81^{\circ} 30'$  by its drifting into that opening.

The coast of Greenland, at the furthest point reached, is steep and precipitous, and is free from land-ice; while the shores of Grinnell Land, on the opposite side, appear to be low and shelving, and have fast ice attached to them. The extreme northern points of Greenland and Grinnell Land appeared to reach to about the same latitude,  $82^{\circ} 20'$  N.; and beyond them, with a channel about 50 miles in width intervening, a distant polar land was made out, in about  $84^{\circ}$  N. This will probably be that "paradise of birds" where the knots go to breed, and all the other vast congregation whose place of nidification has not yet been discovered. But there is reason to think that, at some time or other, human beings have been there also, for at the furthest point reached by the *Polaris* the vestiges of man were found. They consisted of a couple of walrus ribs, which had been used as sledge-runners; a small piece of wood that had formed part of the back of a sledge; an old bone-knife handle; and the remains of a summer encampment—three circles of stones for keeping tents in position, with spaces left for the entrances. Traces of the presence of man on the verge of the unknown region are proofs of its being habitable, and consequently of the presence of open water and much animal life.

A regular current was flowing down the strait from the north, and the prevailing winds were from the north-east. In  $82^{\circ}$  N. much drift-wood was seen; and Mr. Chester, the mate, picked up a piece, 4 feet long, which most probably was borne on the waves of a Polar sea, from the coast of Siberia. The most interesting discovery connected with oceanic movements was that the tidal waves from north and south meet at Cape Fraser, on the west coast of Grinnell Land. This was fully demonstrated by the drift of the *Polaris*, and by tidal observations. To the south of Cape Fraser the flood-tide makes to the north, whilst to the north of that point it flows south. The rise and fall during spring-tides was about  $5\frac{1}{2}$  feet, and during the neaps about 2 feet. No agitation of the water was noticed off Cape Fraser, caused by the meeting of the two waves, for the ice would effectually prevent anything of the sort. To the south of Cape Fraser the tide

rose to a greater height during the night, as is the case along the coast of Greenland; whereas to the north of Cape Fraser there was no perceptible difference between the day and night tides.

Turning from the experience of the *Polaris* during the navigable season to what is to be learned from the story of winter quarters in Polaris Bay, the details are equally instructive. This expedition passed the winter in  $81^{\circ} 38' N.$ , a point considerably further north than any human being has been known to have wintered before. The prevailing winds were from the north-east, and the lowest temperature registered was  $-48^{\circ}$  Fahr. Now Kane's minimum, in a position 180 miles further south, was  $-69^{\circ}$ , and the minimums registered by expeditions wintering among the Parry Islands ranged from  $-48^{\circ}$  to  $-59^{\circ}$ ; so that the cold certainly does not increase on approaching the Pole. Indeed observations tend to the conclusion that the pole of cold is much nearer to the Arctic circle than to the Pole of the earth. In the comparatively mild climate, between the  $81^{\circ}$  and  $82^{\circ}$  parallels, fifteen species of plants were found, and the herbage was sufficient to sustain herds of musk oxen, twenty-six of which were shot. Seals of three kinds were seen as far north as  $82^{\circ} 16' N.$ , besides foxes and lemming, ptarmigan, seventeen other kinds of birds, including the rare Sabine gull and the Iceland snipe, and several insects. With the exception of poor Hall himself, not a man of the expedition died, although many were far advanced in years and had led hard lives, and all returned in perfect health.

We learn from the voyage of the *Polaris* that a vessel may steam up Smith Sound to  $82^{\circ}$  or  $83^{\circ}$ , and probably much further, without any difficulty; that land exists in  $84^{\circ}$ , or at a distance of only 350 miles from the North Pole; that currents and tides, ebbing and flowing between Baffin's Bay and the Polar ocean, keep the ice within the strait in constant motion, and indicate its navigability at intervals during the working season; that the climate far to the north is milder than in the more southern portions of the Arctic regions; that there is great abundance of animal life; and that the subjects for scientific investigation, which have been indicated by the labours of Dr. Bessel, are even more numerous and interesting than had been anticipated.

Let us now turn to the voyage of the *Arctic*, and contemplate the remarkable change which the use of powerful steamers has caused in ice-navigation. The *Arctic* is a steamer of 439 tons and 70 horse-power, with angle-irons on each side of the stem, and strongly fortified inboard. Her first encounter with ice was in Davis Straits, when Captain Markham was a witness to the way in which she forced a passage through 50 miles of formidable pack, in which a

sailing vessel would have been perfectly helpless. Then came the passage through Melville Bay, between the land-ice and the moving pack, which had been the terror of the whalers for the last half century. There are several persons in this meeting who have been in Melville Bay for thirty and forty days, in a sailing vessel, or still worse, in a steam-tender, obliged to wait upon a sailing vessel, tracking and blasting, sawing and cutting, and wearing their lives out with bitter annoyance at the delay. Now, this year was not exceptionally clear; there was a good deal of ice, and much care was necessary, as well as some little charging of the ice, and judicious audacity. Yet the *Arctic* succeeded in passing through the ice of Melville Bay and reaching the North Water in sixty hours. Again, when beset several times in the middle ice, and in Prince Regent's Inlet, the *Arctic* was able to force her way through pack in which a sailing vessel would have been utterly helpless. To one who, like Captain Markham, had studied the records of Arctic voyages with care, these performances of the steamer in which he was taking a passage were most suggestive. There was nothing to have prevented her from proceeding up Smith Sound in the track of the *Polaris*, if the Captain could but have been persuaded that there were whales in that direction. The whale fishers are very slow to go off the old beaten track without some strong inducement, and a Government expedition must lead the way and bring to light the capabilities of the unknown region as regards the yield of oil-producing animals before its productions are sought after by traders. But even in the ordinary course of the fishery and during a short summer cruise the *Arctic* went further than the expedition of Sir Edward Parry in 1824, or of Sir James Ross in 1848; than that of Mr. Saunders in 1850, of Captain Forsyth in 1850, of Mr. Kennedy in 1851, and nearly as far as that of McClintock in 1858. These facts show the great change that steam and other modern appliances have effected in ice-navigation, for the voyage of the *Arctic* this year was not exceptional. The same voyage, with the exception of the run down Prince Regent's Inlet to Cape Garry, has been made year after year since she was built.

Captain Markham was thus enabled to visit the scenes of winter quarters of former Arctic expeditions, which have become classic ground in the glorious annals of northern discovery.

At Port Leopold he examined the traces left by the expedition of 1848, under Sir James Ross, with whom the late Sir Robert M'Clure, Sir Leopold McClintock, and Captain Cheyne, were serving. Here were the framework of the house on Whaler Point, the steam launch, and the great dépôt of provisions, and Captain Markham picked up

a cylinder red with rust, containing the numerous records left by Sir James Ross and others, all soaked with wet. As they must have perished if they had continued there, he carefully dried them and brought them home, delivering them into the hands of Sir Alexander Milne. A notice of what he had done was written out, and secured in the cylinder to one of the posts of Sir James Ross's house. The provisions at Port Leopold, which had been lying there for twenty-five years, were in a wonderful state of preservation : the biscuits being as good as when baked, and the tobacco and chocolate quite fresh. About 230 casks, of different sizes, were lying about in all directions.

After cruising about for some time in Lancaster Sound and Barrow's Straits, the *Arctic* made a run down Prince Regent's Inlet into Creswell Bay, and beyond Cape Garry, where a great number of whales were found ; and this inlet thus bids fair to become an important fishing station, as Sir Edward Parry prophesied many years ago. This gave Captain Markham another opportunity of visiting a spot which has become classic ground in the annals of Arctic adventure, namely, Fury Beach. Here, it will be remembered, H.M.S. *Fury* was forced on shore in 1824, and, notwithstanding the strenuous exertions of Sir Edward Parry and every soul in the expedition to heave her down and repair damages, she became totally unseaworthy, and was obliged to be abandoned. Anchors were laid out on the beach with cables passed round masses of grounded ice, to form a safe wet dock ; all the stores and provisions were landed to lighten her, and there was a display of splendid seamanship. But all was of no avail, and an immense pile of stores and provisions was left on Fury Beach. Sir John Ross, in 1829, took tons away, and, when he and his crew wintered there in 1832-33, they lived on these provisions. The place was last visited by Mr. Allen Young in March, 1859, and no living soul had landed on Fury Beach since that date. Casks, spars, rigging, and a perfect assortment of ship's stores, were strewn about in all directions, with the remains of "Somerset House," in which the Rosses and their men had passed several dreary months. Three bower-anchors were on the beach, two boats, the topsail-yards, and the running riggings of the *Fury* unrove, and jagged up in five-fathom lengths. Hundreds of tins of preserved meat and vegetables were lying about, all in an admirable state of preservation after a lapse of nearly fifty years. And even the rope was quite fresh. There is also a perfect set of whaling implements, including lances and harpoons. Captain Markham brought two home, and one of them, although it has been exposed to the frosts and thaws of forty-eight

years, only required a little rubbing up to be as bright as when it was first made. He also picked up two seamen's knives and a pair of binoculars, which must have belonged to some Arctic worthy of the last generation. Another relic is the small piece of wood, of oval form, from the stern of the cutter, on which the boat's recall had once been painted. Although all the paint has disappeared, the outline of the Union Jack with a pennant under it, can still be made out. The visits to Port Leopold and Fury Beach have been particularly alluded to, because they bring home to us the revolution that has taken place in ice-navigation. Points which were reached with extreme toil and difficulty by Sir Edward Parry and Sir James Ross, and which were the farthest limits of their respective voyages in sailing-vessels, were visited this summer by a steamer without any check worth speaking of, and in the ordinary course of a whaling voyage. It is true that, even in former days, occasional fortunate voyages were made; but what was then the exception is now the general rule. The difficulties of ice-navigation must not be under-stated, but there can be no doubt that those difficulties have been materially reduced by the skilful and seaman-like application of steam-power and other modern appliances. A very great insight may be obtained into the present system of ice-navigation by a voyage in a whaler undertaken by a naval officer; and the idea of despatching Captain Markham on this duty is one which was most happy in itself, and for which geographers are certainly very much indebted to Admiral Sherard Osborn.

The Meeting will, I think, be of opinion that the results of the Arctic investigations in 1873, though humble in themselves, have added something to our knowledge, and will not be wholly unprofitable in furthering the great cause of Arctic discovery.

Admiral R. COLLINSON said his experience in the Arctic regions was limited to the regions east of Behring Straits, but he had advocated from the first the prosecution of Polar research by way of Smith Sound, and he was glad to find that the United States Expedition had been so successful. The voyage of the *Polaris* afforded evidence that further exploration in the same direction would be attended with satisfactory results. Undoubtedly, in the upper part of Smith Sound there appeared to be a rise of temperature, which at present could not be accounted for, and the investigation of this subject was of the greatest possible importance.

Captain CHEYNE (who accompanied Sir James Ross's expedition) said it was his deliberate opinion that it would be a comparatively easy thing for an expedition to reach the North Pole, either in a vessel or by a sledge party; and if England did not now do her duty in this respect, she would find other nations soon surpassing her. The Royal Society and the Geographical Society had always "backed up" Arctic research, and he trusted that they would continue to do so until the North Pole was finally reached.

Admiral SHERARD OSBORN said, after the disappointment of last spring, he was glad to find a naval officer on half-pay who was ready to devote

himself to the best method of obtaining information from the Arctic regions, so as to strengthen the hands of those who intended again to apply to her Majesty's Government for the despatch of an expedition. It was of the utmost importance to know what progress had been made during the past ten years in ice-navigation. He himself, and one or two others present at that meeting, went out in 1850 in the first steam-ship that ever penetrated the ice. Before their departure they had the consolation of being told that they would only live 48 hours in the ice; but they were very soon convinced that a great change was about to take place in Arctic navigation. Captain Penny, a distinguished whaler, said a great revolution would take place, and such had been the case, for at the present day all the vessels that had attempted to penetrate the ice were steamers. Some years ago it was considered lucky if in one season one ship out of three could cross the middle ice, but the captain of the *Arctic* told him that for nine consecutive years he had never failed to pass through it. Captain Markham had seen how this was accomplished. The change was most remarkable; for here was a whaler, not sent out to run unnecessary risk, but merely in the ordinary way of business, passing the extreme point reached by some half-dozen Arctic expeditions, and returning, a full ship, two months earlier than the period at which whalers formerly came home. She was back early in September, whereas, twenty years ago, whalers thought themselves fortunate if they reached home by the 14th of November. The Arctic whale-fishery was the best school in the world for mercantile seamen. Arctic whalers were the pick of the mercantile marine. Their labours were continuous, and the risks they ran were extreme. They had to hunt a fish which would assuredly destroy them if they did not kill him. They ventured among the ice in the boldest way, and thought nothing of leaping from their beds into their boats and working in them 13 or 14 hours before they returned to the ship. Yet this great school for our seamen would have been closed years ago, if it had not been for the labours of Arctic explorers. The old Spitzbergen field was discovered in the course of Arctic exploration. Davis discovered Davis Straits, where the fishery continued for years, and the whalers never passed through that ice until Sir John Ross fought his way through and discovered whales further north. From that time the whalers forced their way through the middle ice. Parry discovered the fishery in Prince Regent's Inlet, and declared that it would be the great fishery of the future, and whenever the captain of the *Arctic* reached that ground he invariably filled his ship. No doubt there were other parts in which the whales congregated after being driven from their old grounds, and undoubtedly, if future Arctic explorers discovered fresh fisheries, the Dundee and Aberdeen fishermen would follow in their wake. It was a remarkable commercial fact, that the whale-oil of the Arctic Seas was largely used in the preparation of a fibre produced in British India—jute. The quantity of this material that was worked up in Dundee was enormous. During the last eight years he had been concerned in the manufacture of submarine cables, for which tens of thousands of tons of jute had been required, and every ton of it had to be manipulated with whale-oil brought from the Greenland Seas. This was a curious fact, showing how wonderfully one branch of commerce was connected with another. He attached great importance to the fortunate meeting of Captain Markham with the crew of the *Polaris* before they had been dealt with by the reporters of the New York press, and also before any attempt was made in New York to make the tales of the two parties coincide. One-half the crew of the *Polaris* drifted during a snow-storm on an ice-field down to the coast of Labrador, and reached the United States some months ago. The remainder of the crew were met with by Captain Markham in the *Arctic*, and by another whaler, the *Ravenscraig*, during the past whaling season in Baffin's Bay. They had abandoned the *Polaris*, and were going south in their boats to the Danish

settlements. The story given by the men was a very clear one. There could be no doubt that they had run 720 miles, from Cape Shackleton, in the month of August, up Smith Sound, without meeting with any important impediment, up to the furthest point yet reached by any vessel, in fact, within a few miles of Parry's farthest north latitude from Spitzbergen. The man who was the heart and soul of the expedition then died, and from that time no further effort was made to proceed northwards, though there was plenty of water and sailing ice, and though one of the men, who went up on a hill near where they wintered, saw far to the north high Polar land. The *Polaris* found the west coast of Smith Sound to be a very indented coast, evidently a part of that great Arctic archipelago known to English navigators. The crew of the *Polaris* were so aged that Captain Markham said he could hardly call one of them an efficient, able-bodied seaman, and not one was fit to be put into a sledge. There were, too, more captains than seamen. Yet that wretched crew did not lose one man throughout the whole winter. The only person who perished was Captain Hall, and his death was so unexpected that it aroused suspicions of his having been poisoned. Much could not be said of the mild temperatures existing, as the Pole was approached, until the publication of the data, but in a general way it might be stated that it was milder in the upper part of Smith Sound than further south. Every seaman of the crew assured Captain Markham that the tide came from the north, and there could therefore be little doubt in an ordinary man's mind that it must come from some great sea north of Spitzbergen and Greenland. There was no force of water from the west, so it must come from the Atlantic through the Polar current.

Mr. R. H. PRANCE suggested that, if the Government did not think it worth while to fit out another expedition, the Royal Geographical Society should undertake to do so. He was quite sure that sufficient funds could easily be obtained by public subscription.

Admiral SHERARD OSBORN said he had weighed the same suggestion for the last ten or twelve years, and he would be the last man to go to Government for help if he thought it right that a private expedition should winter in the Polar Sea. Experience had taught him that the readiest way to commit her Majesty's Government to successive Arctic expeditions for several years to come, would be to fit out a private expedition under a bold leader and get him to push into the Polar Sea. The probabilities were that the whole country would then be roused, and search expeditions sent out for the next quarter of a century, but such a proceeding he would never be a party to. In order to have a perfect Arctic expedition it was necessary that it should be under Government auspices, with naval discipline, naval order, and naval *esprit de corps*, to carry them through the labours of an Arctic winter and spring. He could not in public state what he knew of the sufferings of some of the American expeditions, and the causes of those sufferings; but the starvation of Kane's people arose from want of organisation and open mutiny, and Captain Hall had to take the life of almost his only companion in the Gulf of Boothia. He therefore thought it would be a great mistake for private enterprise to do more than supplement a Government expedition, by taking care after a public expedition had sailed, to keep open communication annually between the dépôt ship and England.

Mr. PARKER SNOW said he knew Captain Hall intimately. For a considerable time he had his private journals in his possession, and was therefore acquainted with the inner heart of the man, and was convinced that he was about the last person whom the American Government should have placed in command of so important an expedition. A more gallant, brave, and enduring explorer did not exist, amongst his own loved Esquimaux; but it required a naval man, and strict discipline, for such an undertaking as that in which the

*Polaris* was lost. He himself considered it a national duty on the part of England to accomplish that which she had been striving after for over 300 years. In 1850, when, as second in command under the late Captain Forsyth, they ran through Baffin Bay, Lancaster Sound, and down Prince Regent Inlet, to the very position reached this year by the *Arctic*, they found open water, until they reached a barrier of ice below Fury Beach. They then turned back, and arrived home in safety, never having dropped anchor during the four months they were out. He thought a small topsail schooner, of course with auxiliary power, would accomplish as much as a large steamer. Any expedition sent out should remember that Franklin's journals were as yet undiscovered, and numerous bodies of our unfortunate countrymen unburied, also that round by Behring Straits the coast is navigable right up to King William Land.

*Second Meeting, 24th November, 1873.*

SIR H. BARTLE E. FRERE, K.C.B., K.C.S.I., &c., PRESIDENT, in  
the Chair.

ELECTIONS.—*Lieut. William Alison Dyke Acland, R.N.; C. E. Alforth, Esq.; John Allen, Esq.; Henry Cavendish A. Angelo, Esq.; Lieut. G. George Baker-Cresswell (66th Regiment); Henry Howard Batten, Esq.; W. T. Blanford, Esq.; Lieut. H. C. Carey (late 1. N.); Frederick Dundas Chauntrell, Esq.; Samuel Cheetham, Esq.; Sir John Clark, Bart.; Kenneth Cochrane, Esq.; John Constable, Esq.; Emilius Albert de Cosson, Esq.; George Ponsonby Craufurd, Esq.; Chief Justice Charles P. Daly, LL.D. (President of the American Geographical Society); Rev. R. V. Faithfull Davies, M.A.; William Elmslie, Esq.; James Farmer, Esq.; W. F. Forbes, Esq.; Thomas Forshaw, Esq.; Edward William Foss, Esq.; John Louis Geiger, Esq.; James Gibbs, Esq.; Arthur Leo Gordon, Esq.; W. E. Heeley, Esq.; Charles John Hegan, Esq.; William Henry Hirst, Esq.; Rev. John Jones; Winslow Jones, Esq.; Colonel J. P. Kennedy, R.E.; John Dunkin Lee, Esq.; Thomas Letts, Esq.; Thomas Lovell, Esq., M.I.C.E.: Colonel Richard G. A. Luard; Sir Francis Lycett; William Macaulay, Esq.; Archibald MacEachen, Esq.; William Mackenzie, Esq., M.D., C.B.; Kenneth W. A. G. McAlpin, Esq.; Commander Albert Hastings Markham, R.N.; Henry Mere Ormerod, Esq.; Edward Lavington Oxenham, Esq.; Frederick Adolphus Philbrick, Esq.; John Samson Prince, Esq.; Dr. Don Manuel Gonzalez de la Rosa; Ernest E. Sabel, Esq.; Colonel W. H. Seymour, C.B.; Dr. Porter Smith, M.D.; Joseph Straughton, Esq.; George Sutherland, Esq.; Charles Taylor, Esq.; John Tomlinson, Esq.; Hon. George Turner; William James Tyler, Esq.; Lionel N. Walford, Esq.; William T. Western, Esq.; Eugene H. Winslow, Esq.*

PRESENTATIONS.—*Dr. Don Manuel Gonzalez de la Rosa; W. L. Lawrence, Esq.; James Price, Esq.; Neville Hart, Esq.*

ACCESSIONS TO THE LIBRARY FROM NOVEMBER 3RD TO NOVEMBER 24TH, 1873.—‘L’Empire du Brésil à l’Exposition Universelle de Vienne en 1873.’ Rio de Janeiro. Donor Don Pedro de Alcantara. ‘J. M. Macedo.’ Translated by H. Le Sage. Leipzig, 1873. Donor the Emperor of Brazil. ‘Narrative of a Voyage from Sydney to Torres Straits.’ By W. E. Brockett. Sydney, 1836. Donor S. M. Drach, Esq. ‘Geographical Description of Ireland.’ 36 Maps. By J. Bowles. London, 1728. Donor S. M. Drach, Esq.

ACCESSIONS TO THE MAP-ROOM SINCE THE LAST MEETING OF NOVEMBER 3RD, 1873.—Map of Switzerland, Ober-Engadins (Grisons). On 4 sheets. By J. M. Ziegler, h.c. Presented by the author. Iceland. On 4 sheets. By O. N. Olséns. Presented by the Executors of the late Count P. E. de Strzelecki, c.b., f.r.s., through Sir H. Rawlinson, k.c.b. Historical Atlas of Ancient, Biblical, and Classical Geography. Part III. By Dr. Wm. Smith and Mr. Grove. Presented by J. Murray, Esq., f.r.g.s. Republic of Chili. On 13 sheets. By A. Prassis, Esq. Presented by Don Carlos Mórla Vicuña. Map of the Gold Coast and Kingdom of Ashantee. By W. and A. K. Johnston. Presented by the publishers.

The following were the papers of the evening:—

1. *Recent Discoveries in the South-Eastern Part of New Guinea.*  
By Captain I. MORESBY, R.N.

[ABRIDGMENT.]

THE *Basilisk* left Sydney, December 8th, with orders to suppress the illegal employment of Polynesian natives by the pearl-shellers in Torres Straits. This having been easily and quickly accomplished, I found myself with much spare time on my hands, and resolved to employ it in completing, so far as our time, means, and ability would permit, the unfinished survey of Captain Owen Stanley, of the south coast of New Guinea.

The information thus obtained I will divide into three sections for clearness:—

*First Section.*—Islands and coast of New Guinea, in Torres Straits.

*Second Section.*—Coast of New Guinea, between  $146^{\circ} 20'$  and  $148^{\circ}$  E.

*Third Section.*—From  $150^{\circ}$  E. to east extreme of New Guinea.

SECOND SECTION.

Between Yule Island and Hood Point, 120 miles, the whole of this coast-line was laid down by the running survey of Captain Stanley in 1849; but it appears that the only point landed upon was

the shores of Redscar Bay, where, after a very brief intercourse with the natives, symptoms of hostility were suspected, and the party at once returned to the ship.

The *Basilisk*, when about 25 miles E.N.E. of Yule Island, found herself at daylight off a vast extent of drift-wood and uprooted trees of great size. They were first reported as *reefs*, causing considerable anxiety until daylight revealed their real nature. I was led by this to suppose that inside Yule Island I should find a large river which might prove a road to the interior of New Guinea. This was my ambition.

Yule Island lies off the entrance to a large well-sheltered sheet of water (now named Robert Hall Sound), where the *Basilisk* remained several days.

The island is about 550 feet in height, well cultivated and fertile. The mainland, excepting some bold headlands, is one vast extent of low swampy ground, extending for 6 or 8 miles inland to a low range of hills. These are backed up by range after range until they culminate in the magnificent "Owen Stanley" Mountains, 12,000 or 14,000 feet high.

I was utterly disappointed in finding *no* river which led to these tempting highlands. A river we found spacious and stately enough to raise our hopes extravagantly; but after following its sluggish course for many miles it led *nowhere*, and was but the drainage of the immense surrounding fresh-water swamp. A powerful river emptied itself into this first stream, but its current was too rapid to admit of my six-oared galley ascending more than a very short distance: it was probably the parent of the *drift* seen at sea.

The scenery on the river-banks was monotonous in the extreme—a dense growth of mangrove and other moisture-loving trees. Excepting flying foxes and screaming gaudy-coloured birds, there was an entire absence of animal life.

Occasionally ill-made native huts were on the banks, from which a track through the swamp led to some acres of raised ground, like an oasis in a desert. These were carefully cleared and cultivated with yams, taro, bananas, &c. Here also were permanent houses, built as usual on poles some 8 feet from the ground, with one room common to the whole family. The natives hid themselves in the swamp; indeed it must have appeared to them as if we had dropped from the clouds.

It seemed marvellous how human life could exist in such a malacious, vile place. Even in the glare of a noonday sun the air was thick with mosquitoes.

In "Robert Hall Sound" the ship was always crowded with

natives, fresh parties from distant parts of the coast arriving each day. They are a copper-coloured race, combining both dark and light shades, decently clothed, the men wearing a breech-cloth, the women the usual Ti-ti, or South Sea petticoat. The men have their hair frizzled out as a mop, but the women cut theirs short, and extensively tattoo their bodies, which the men never do. They ornamented themselves with black, white, and red pigments, variously laid on; bunches of flowers and birds-of-paradise plumes fastened to their heads and shoulders. Occasionally the great beak of the hornbill was worn as *horns* on each side of the head; the men's mouths were all much disfigured by excessive use of lime and betel-nut. Their weapons are bows, arrows, spears, stone and wood clubs. They were totally unacquainted with the use of iron, and infinitely preferred their stone hatchets to our axes. The barter they the most liked was the polished pearl shells of Torres Straits.

None of their villages are visible from the sea, being placed in the bush in cleared spaces, very neat and cleanly kept. In the rear of the villages are generally extensive well-fenced plantations of yams, bananas, &c. No signs of cannibalism were visible.

They gladly received us at their villages, and impressed us as a friendly, intelligent people. Being so distinct a race from the black naked New Guinea men of Torres Straits, it will be very interesting to ascertain *where* the line of demarcation occurs. It is probably not far to the west of Yule Island; for at Cape Possession (25 miles to the west), in 1846, Lieutenant Yule remarks "that the natives varied in shade, from nearly black to a light copper colour," or perhaps it may be at some spot where the betel-nut first grows, to the east of Torres Straits, which the black race never use, the light race always. Some fine specimens of steel sand were found on the mainland near the sea.

Redscar Bay is, during the south-east monsoon, a wild, exposed anchorage; the surrounding country low, swampy, and malarious, intersected by many large streams flowing from the "Owen Stanley" range. I spent four or five days in vain efforts to reach the mountains by means of these rivers, but in every case, after ascending 12 or 14 miles, when the country began to be somewhat open, the current became so rapid, snags and uprooted trees so numerous, it was impossible to go further. Their banks are very similar to the rivers at Robert Hall Sound; they are more frequently fringed with what (for want of knowledge) I call a bastard palm—a palm without any trunk, which flung its gigantic leaf-branches 40 or 50 feet, arching over the rivers. Some smaller species were armed with innumerable *hooks* on the edge of the leaf, which lacerated us

cruelly, as trying to avoid the current we kept close to the banks.

When clear of the swamps the rivers ran between dense tropical forests, the trees of no great girth, but towering to fabulous heights: I should say from 200 to 250 feet. Even this height could not save them from the destructive climbing parasites, which, reaching to the loftiest branches, destroyed their life, and hung round the dead limbs in most weird and fantastic shapes.

The largest of these rivers was blocked up by an accumulation of logs and snags, which, interlaced together, had bridged the river, and being continually added to from above, had formed large vegetated islands, under which the river rushed and foamed furiously. Just below these islands it was about 80 yards broad, 20 feet deep, and very rapid.

Redscar Bay is the ill-chosen site of a Polynesian native mission, belonging to the London Missionary Society. The unfortunate teachers, little better than children themselves, and left to their own resources, are dying off rapidly.

Immediately to the east of Redscar Head the outlying *barrier reef* rears itself to the water's edge, at a distance varying from three to eight miles from the shore, and guards uninterruptedly the coast as far as Hood Point, from aught but gentle wavelets. Simultaneously with the appearance of this guarding reef the entire features of the country change. The whole coast between Torres Straits and Redscar Head is as a rule low and swampy, and has probably been formed during the course of ages by the alluvial deposits of the numberless large streams descending from the great Owen Stanley Range. Now precipitous, round-topped, grassy hills, openly timbered, and bearing a strong family likeness to each other, spring from the white coral and sandy beach. These hills are backed up by higher ranges inland. Fertile valleys lie between.

The coast is strewn with villages, always marked by a grove of coco-nut trees. The houses are built after the Malay fashion, on poles, some standing far out on the shore reefs in quiet waters, others clustering amongst plantations on the hill-sides.

It is singular, this sudden change from a low, muddy, mangrove-bound coast, to boldness, coral-shells, and white sand! Perhaps it is caused by the courses which the rivers from the mountains take?

From Redscar Head to Hood Point not a single stream was seen emptying itself into the sea—small trickling rivulets were found and *water holes*, no clear, running stream. The soil in the valleys is of a peaty, black, spongy nature, which probably absorbs the rain as it falls.

Close to the Fisherman Islands of Captain Stanley, the *Basilisk* passed through the Barrier Reef by one of those narrow, bottomless openings peculiar to these seas, and anchored in a fine roomy harbour within a harbour (now named Port Moresby and Fairfax Harbour), which our boats had previously discovered. The ship remained here some days, whilst running surveys were made and the coast explored.

In the neighbourhood of Port Moresby the valleys were intensely rich and tropical in their vegetation; but the hills, of which the greater part of the country consisted, were perfectly Australian in their appearance: they had very poor soil, covered with large stones, scattered gum-trees, and thin grass. On some of these hills large quantities of quartz were found; some of the specimens picked up being impregnated with gold, but no trace of gold was ever discovered amongst the natives.

The description of the Yule Island natives may generally be applied to the natives of this part of the coast, but these appear a more harmless and inoffensive race. I do not remember seeing more than one armed native during the month we spent amongst them.

I frequently examined their canoes, trading up and down the coast for long distances and calling at distant villages, and found them equally destitute of weapons. Many of these canoes were of the kind described by Lieut. Yule, of H.M.S. *Bramble*, in 1846, viz., *double* canoes, secured by a cane deck or platform passing over all and fastening the canoes together. They were propelled by large mat sails spread between two poles in the shape of the letter V, and steered with long paddles; their length was about 40 feet, and extreme beam about 8 feet. No treble or quadruple canoes of this sort were seen by us.

In their houses they had rough-wood spears, and occasionally stone clubs, no bows.

We roamed over the country, and visited their villages as freely as if they were English people. If any of our fellows got lost in the bush, the natives took them to their villages, fed them, and offered every hospitality, before bringing them back to the ship.

Apparently they had never before seen a white man, as their curiosity was great to see and touch our white skins.

From their proximity to Redscar Bay they had learnt the use of iron, eagerly taking our axes in barter. Their fishing-nets, made from the fibre of a small nettle-like plant (I did not see its leaf) are precisely similar to an English seine, quite as strong, and are universally used from Yule Island to East Cape.

*Wallebies* were the only wild animals seen. Pigs and dogs the domesticated ones.

### THIRD SECTION.

This commences at Heath Point, where Captain Stanley began his survey of New Guinea, distant about 40 miles from the (then) supposed south-eastern extremity. The chart shows an unbroken continuation of the Owen Stanley range to near the (supposed) south-eastern cape.

The north-eastern shores of New Guinea had never been surveyed, but all the charts agree in representing the eastern termination of New Guinea to be in the shape of a *wedge*, with the D'Entrecasteaux Islands on its north-eastern board.

The reality we have found to be very different, as the rough tracing will show you. You will observe that New Guinea finishes its enormous length to the eastward in the form of a broad *fork*. Heath Point, of Captain Stanley, is a lofty island lying off the mainland. Thus Captain Stanley in reality commenced his survey at the extreme south-eastern point of New Guinea without being aware of it.

It was probably thick weather when his soundings were taken within two miles of Heath Island. Under any circumstances, from the westward Heath Island shuts out all view of the straits, named by me "China Straits."

The tracing will obviate my making any lengthened remarks on the unexpected configuration of the land which it has been our lot to discover. I will briefly say that the south-eastern extremity of New Guinea sweeps precipitously down, from a height of about 2000 feet, to the tranquil shores of China Straits; those on the opposite side have Hayter Island, irregularly shaped, rising to a height of about 800 feet.

Hayter Island, separated by a narrow pass (riven asunder by some mighty convulsion of nature) from Mourilyan Island. This latter island is of a moderate height on its southern board, but to the north-east rises to about 1200 feet, and is separated by Fortescue Straits from Moresby Island, a noble island with peaks about 2000 feet.

It is a curious question *how* it has come about that the mistake of supposing New Guinea to end in a wedge-like shape should have occurred. It may have been thus:—D'Entrecasteaux and the old navigators knew of the existence of the north-eastern fork, and placed their discoveries relatively correct with regard to it; they knew nothing of the south-eastern fork. Modern navigators, making

the land from the south, knowing nothing of the north-eastern fork, and seeing the high land of that part of New Guinea over the low land of Mourilyan Island, hastily jumped at the conclusion that it must be the D'Entrecasteaux Islands: thus confusion arose, and the fork was *shut up*. It is clear enough now.

I am strongly of opinion that the route between China and Australia will eventually lead through China Straits (they are free from dangers, and have safe anchorage everywhere). A ship leaving Sydney would follow the outside route to the Great North-East Channel, a clear free sea, from that well-known track, leading to China Straits; thence to East Cape is a clear run. There the *Basilisk* was brought up by reefs. Unfortunately a want of stores and fuel prevented our looking for a passage (which will undoubtedly be found) to the south of *Lydia* Island.

I examined the northern shores of New Guinea, for about 25 miles, in my boat. Once round East Cape, New Guinea is washed by a grand, clear, reefless sea: a ship might literally sail with her sides rubbing against the coral wall which binds the shore, and find good anchorage in any of the bays where a beach is seen. How far to the westward this description would apply remains to be proved: it is an important matter, and well worth early investigation.

Of the beauty and fertility of these islands and shores of New Guinea it is impossible to speak too highly; in its general features it strongly reminded me of Jamaica. The precipitous wooded mountains are to a considerable extent cleared and terraced to their very summit with taro and yam plantations, in a way that even a Chinaman might envy; whilst the valleys produce coco-nut, sago-palm, bananas, sugar-cane, oranges, Indian corn, guavas, mammy apples, pumpkins, and other tropical productions. Mountain streams abound, and contain a delicious eatable fish, almost identical in taste and appearance with the English trout.

The torrents which discharge themselves from the mainland into Sir Alexander Milne Bay are very numerous and large; no fish were seen in these.

At the head of Sir Alexander Milne Bay fine specimens of steel sand were obtained. At East Cape the natives possessed large lumps of obsidian; but we did not see that it was used to barb spears or make knives, as at the Admiralty Islands.

The whole of these coasts, except where the mountains rise too precipitously from the sea to give foothold to man, which is often the case, are thickly populated.

The natives are of a lighter copper colour than those previously

described, slightly limbed, and active, with bright, intelligent features; many would be good-looking but for the disfigurement caused by the betel-nut. Their taste in painting themselves is peculiar; with charcoal and oil they at times make themselves a sooty black, others will paint black spectacles round their eyes, blacken their nose, and lime their cheeks and chins white, giving themselves a most grotesque appearance. They are fond of wearing bright flowers, birds' plumage, and long, ornamented streamers of the pandanas fastened to their shoulders. The septum of the nose was perforated, and a polished bone thrust through. Occasionally they wore human jaw and spinal bones as bracelets and ornaments.

The women wore their hair short, and were extensively tatooed; the men never.

They are fond of making pets of parrots, cassowaries, and different species of a sloth-like marsupial little animal, which, being somewhat like the Australian bear, we termed Opossum Bears. One species, with a soft greyish fur, was very beautiful; we could not succeed in keeping them alive on board.

The men appear to do all the canoe-work—fishing, and so on—leaving the field labour for the women; nevertheless, the women appeared to have their say, and make the men do as they pleased in matters of barter. The men were frequently seen nursing little children with much affection. A striking, distinguishing mark of the superior civilization of the light-coloured race to the black New Guinea men is the acquaintance of the former with the art of common pottery. At all their villages various sizes of earthenware pots were seen, and others in process of manufacture. They are neatly moulded by hand to the required shape, and then baked by heaping fire round the clay.

Their weapons are handsomely-carved wood swords, clubs and shields, wooden spears and stone tomahawks, but no bows. They were perfectly aware of the value of iron, specimens being found in every village; doubtless obtained from the Eastern Islands, with which a constant communication is maintained by means of large trading canoes.

These are from 40 to 50 feet in length, the bottom consisting of a hollowed tree, upon which the top sides are raised and secured by a strong cane lacing and large wooden knees; they are propelled by an oval-shaped mat-sail, very skilfully handled, and quite capable of making long voyages. Meeting them at sea, the *Basilisk* going 5 knots, they easily sailed round us, and, luffing under our lee, were with difficulty prevented from boarding whilst we were under weigh.

The other canoes in use are small, and the catamaran is universal. Besides these, each village has several long, narrow, *war* canoes, highly ornamented after a barbarous fashion, carved and painted, capable of holding forty or fifty men. They are kept very carefully hauled up under sheds, and bear the appearance of being but seldom used.

With these people our intercourse was of a most satisfactory, pleasant nature. At first they were a little shy; but this was speedily got over, and a free interchange of barter went on, pieces of hoop-iron being the great medium of exchange. They eagerly exchanged their handsome stone hatchets and other valuables for a piece of the coveted iron; many tons of the finest yams were also bought with it.

On all possible occasions I gave our ship's company liberty to go on shore, and mix freely with the natives; the results were all I could desire—perfect good feeling and confidence on both sides. Nor was there a single instance of our men insulting the women, or of the natives making immoral offers. The greater part of our surveys being done in boats, I had frequently occasion to land in my six-oared galley at large populous villages, 18 or 20 miles from the ship, surrounded by large crowds; yet we were always received in the same friendly, hospitable spirit as if in sight of the ship; nor do I think that they had any idea that we possessed weapons more powerful than their own.

They would, if possible, pilfer, when on board, but in bartering, were strictly honest. Take them altogether, they are as genial and pleasant a race of savages as could well be met with: at the same time, I have no doubt, they do a little cannibalism among themselves. They took pains to make us understand, as an event they were proud of, that they had eaten the former owners of the skulls (hung up in their villages) and human bone ornaments which they wore; but the skulls are few, and apparently of an ancient date. As they have a superabundance of food, I am inclined to think it is only on *very* rare occasions they make a raid or do any fighting amongst themselves. I never saw a wounded man amongst them.

I think it is very likely that the inhabitants of the large out-lying islands stand very much in relation to the New Guinea men as the Danes and Norsemen of old did to the ancient Britons. On one occasion, when lying in Fortescue Straits, we were visited by some large *Island* canoes: immediately they appeared all the New Guinea men cleared out, and were seen no more until the strangers had left.

We could not trace any sign of religious worship amongst any of

these copper-coloured races, unless stringing up thousands of coco-nuts on poles fixed on the reefs in the front of their villages—in fact everywhere—may be regarded as a propitiatory offering. They never move out after dark, and probably, like other savages, have a belief in, and dread of, devils and evil spirits, but no knowledge of any good spirits.

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2. *Three Visits to New Guinea.* By the Rev. W. WYATT GILL, B.A.

FIRST VISIT TO MAUAT.

On a bright morning, the 27th of October, 1872, I first saw from our anchorage at Tauan, the low south-western coast of New Guinea, like a dark line drawn across the horizon. The vast unknown land was but four miles distant. One sympathized with the exultant cry of the immortal Ten Thousand on first catching a glimpse of the Euxine, Θάλαττα, θάλαττα.

About the same distance from New Guinea, but separated from Tauan by a narrow strait of  $3\frac{1}{2}$  miles, lies the sister island of Saibai, as yet unmarked on charts. The chiefs of these islands are brothers. The inhabitants speak a dialect, and practise the customs of the mainland, and maintain a friendly intercourse with the people of Katau and Torotoram. And yet, perversely enough, the portion of New Guinea in sight is entirely inaccessible to strangers—the tribe occupying it being in constant feud with their neighbours on the mainland and on the adjacent islands.

Five teachers of the London Missionary Society greeted our arrival at Tauan. Next day the Rev. A. W. Murray and I sailed in a boat to Saibai, which is a low, fruitful, unhealthy island. The interior is a vast morass, with myriads of snipes, curlews, &c., &c. The inhabitants are a fine Negrillo race, suspicious of strangers. The women here, and on the mainland, are excessively timid; they are slender in figure, wear a meagre grass petticoat, and have their heads closely shaved.

On Saibai and Tauan, the houses of chiefs and warriors are ornamented with strings of skulls of New Guinea bushmen. The owners of these ghastly trophies were very unwilling that we should touch these “malakai,” i.e. ghosts. In the village stands a lofty coco-palm, with two branches growing out of the parent stem at the same point. All three crowns were richly laden with fruit—a botanical fact new to me. Their war-weapons and house-building are of a superior kind, precisely similar to what we afterwards saw on the mainland of New Guinea.

At daylight on the 29th of October, we steamed for Katau, a village distant some 20 miles on the south-western coast of New Guinea. As we passed along, the eye wearied of miles of stately, melancholy mangroves, very unlike the scrub bearing that name I afterwards saw in Queensland. A conical hill, some miles inland, alone relieved the monotony of the scene.

The navigation of this unsurveyed coast is most critical. At 3 p.m. we touched an unknown coral-reef, without however receiving damage. Next day, a few miles farther on, we discovered at low water sunken rocks lying in the direct path of the steamer.

Our proximity to Katau was indicated by an apparently interminable forest of coco-nut palms. The dwellings composing this village—the first we had seen on the mainland of New Guinea—are but few in number, but of immense length. On the morning of the 30th we pulled ashore, unarmed, at the western mouth of Katau River. Our interpreters, Mamut and Joe, shouted to the chief Maino, and thus insured us a good reception. We were at once conducted to a covered place in the centre of the village. Unarmed natives crowded about us with smiling faces. The formidable Papuan pipe, sometimes 33 inches in length, was filled with tobacco-smoke, and politely passed round to the visitors, who however declined to *swallow* the fragrant vapour. This pipe consists of a piece of bamboo with a movable bowl. The smoke is drawn into the bamboo by applying the lips to the open end, which is then closed with the palm of the hand. The bowl is now removed, and friends are expected to inhale the fumes through the small aperture.

We discovered a second or eastern mouth to Katau River, thus making the somewhat elevated ground opposite to our first landing-place a picturesque island.

The village of Torotoram is larger than Katau. To reach it we had to wade more than half a mile over a bank of fine black sand. The entire population had fled into the bush, with all their valuables, excepting four or five men, who stood doubtfully in front of a house watching our movements. The very pigs had been taken out of the stys and carried off. But, as soon as it became evident to the scouts that our intentions were pacific, and especially when they heard the voice of Maino calling to them, the whole adult male population came out of their hiding-places and gave us an unmistakable welcome.

Their canoes are invariably hollowed out of a single tree, and measure 45 feet in length. Each is furnished with a double outrigger, and three mat-sails. Mauat natives travel in entire families,

and with all their worldly gear. In the centre of the canoe is a raised platform, on which they carry fire for the purpose of cooking fish, smoking, and for warmth at nights. In little square compartments on this raised platform they stow their property—fish-hooks, lines, firewood, women's grass girdles, &c., &c. In the body of the canoe are large water-jugs with lids. They often spend two or three weeks in fishing on one of the numerous coral-reefs near their coast.

They call us "Malakai," i.e. "ghosts" or "spirits." God is spoken of by our teachers as "the *true* or great Malakai." The heathen of this part of New Guinea, and of the Straits, invariably associate the idea of *whiteness* with their notion of a spirit. Our gifts were elliptically designated "malakai," i.e. ("belonging to) glistening spirits." Very similar to this was the notion formed by the natives of Mangaia, in 1777, of Captain Cook, whom they mistook for a god. The skulls ornamenting the houses of warriors on Tauan and Saibai, are, as already remarked, called "malakai," i.e. ("belonging to) ghosts." Such was their delight at seeing the whiteness of our skins that they would, had they been permitted, have stripped us in order to ascertain whether we were really white, and not, as some imagined, painted like dolls. One actually wetted his forefinger and vigorously rubbed my arm to see if the white would come off! They said we were the first whites that had ever landed at their village.

On leaving, all the men (110) followed us; some carrying food, others helping to drag our boat into deep water. The writer had a double escort of athletic natives, anxious to put their heads under his umbrella. When the food was finally deposited in the boat, and we were ready to start, these amusing savages simultaneously raised the right-hand palm open, and most gracefully bade us, "I auā" = "Farewell."

Not a woman, or child, or decrepit man, was seen by us all that memorable day. Those with whom we had such agreeable intercourse were the fighting-men of Torotoram.

We saw Bristowe Island in the distance. Several villages on the mainland, to the east of Torotoram, were pointed out to us by Maino. This part of New Guinea, from the western limits of the Katau district (indicated by a river opposite the uninhabited islet Kau) to Bristowe Island, is called *Mauat* by the natives themselves, and by the Torres Strait islanders.

Opposite to Bristowe Island is a deep navigable river, half a mile across, supposed to be a branch of the Fly. Captain Hastings went up 5 or 6 miles in search of a missing boat. He found no village

whatever,—the entire country being a swamp. Yet there were evident traces of inhabitants; as here and there places had been cleared for canoes to rest at night, and baskets were still hanging on the lopped mangrove-trees. The river was swarming with crocodiles.

The aborigines of this part of New Guinea call their great island *Daudai*. Torres Strait islanders corrupt this into "Daudi," just as they corrupt "Torotoram" into "Tureture." Australia is known as "*Great Daudai*," New Guinea as "*Little Daudai*." Although we spent upwards of seven weeks in New Guinea waters, never once did we hear this famous island called "Papua."

The drums of the Mauat natives are, like hour-glasses, smaller in the middle than at the extremities. One end is invariably covered with iguana-skin. The other is open, but carved so as to represent a crocodile's mouth. A profusion of cassowary feathers usually adorns this remarkable musical instrument, which is about 3 feet in length. When struck with the tips of the fingers the sound emitted is very agreeable. But the songs accompanying the music are harsh and guttural.

Cassowary feathers (of which there seemed to be plenty) are also employed in adorning their grand canoes. I purchased a head-dress of these feathers intended for dancing occasions. In the centre of the forehead a stuffed bird of paradise (*Paradisea apoda*) was inserted as a plume. Their name for the beautiful bird of paradise is "kakaiama."

At dawn of Thursday, October 31st, we parted from our kind friends on board the steamer, and sailed pleasantly in our own little boat along the coast, carefully noting the various indentations. Two small rivers empty themselves into the Straits opposite to two islets not marked on any chart. On one of these islets once stood a populous village; but the Saibai warriors almost exterminated the inhabitants, driving the miserable remnant into the primeval forest of the mainland. The smoke of their distant fires was distinctly visible in the clear October atmosphere; but prudence forbade our landing. Here and there tall mangroves actually grew out of the open sea—their wonderful roots of course resting in some unknown sandbank. We passed several stations for spearing dugong. In seven hours we reached Tauan, a distance of 25 miles.

We asked Sauai one day where the spirits of the dead go. Pointing due west, he promptly replied, "They all go to *Kipo*." He told us that "*Kipo*" is an island in the region of the setting sun, inhabited by disembodied spirits. One would imagine it to be a mythical name for Hades, in accordance with the almost universal

belief of Polynesia, that the spirit-traveller follows the track of the setting sun, and descends with the sun-god Rā into the invisible subterranean world.

#### SECOND VISIT TO MAUAT.

We spent a week on Tauan, awaiting the arrival of a cutter chartered for the purpose of conveying teachers and goods to Mauat and to various islands in Torres Straits.

At last the *Viking*, a cutter of only seven tons, arrived. On the 7th of November this tiny craft, literally packed with passengers, sailed for Mauat. Besides the captain, there was but one sailor, who also officiated as cook. Yet, with the help of our interpreter Joe and the teachers, we succeeded in beating up to Katau the same day, and anchored by moonlight in Katau River. A native stood on the brink of the river to inquire who we were.

At dawn we were roused by a chorus of strange bird-music from the densely wooded islet at the mouth of the river. Strange palms, of immense height, looked contemptuously down upon our diminutive vessel.

Mr. Murray and I at once went ashore to see Maino and the people, who were on the *qui vive*. All seemed delighted at the arrival of their two teachers. A house was at once allotted for their residence (but we advised them to build one for themselves as soon as practicable). In a short time their goods were safely stowed inside—the teachers themselves keeping watch. The wonder of wonders was the landing of the teachers' wives—the first stranger women that ever landed on Mauat. It was pleasing to note their curious, yet perfectly respectful behaviour towards these courageous women. This circumstance entirely diverted attention from ourselves, and afforded us an opportunity of meeting Maino and his brother alone, to impress upon their minds the duty of protecting the teachers left in their charge. "But what, Maino, if the wild bush-tribes should desire to molest them?" The chief smiled, and signified that his was the conquering tribe, asserting that his mere name was a terror to these bushmen. These Mauat men are a fine race, above the average height, but black. Their hair is woolly; their heads for the most part shaved. Their ears were universally slit, and elongated by means of weights, but with a regular series of holes, in each of which was inserted a short piece of the midrib of the coco-nut leaf. Their bows, upwards of 6 feet in length, are the best I have ever seen. They are made of male bamboo, highly polished; strips of which are used as string. These bows carry to a great distance. Their arrows are of reed, of which those in-

tended for killing game (4 feet long) are pointed with hard wood, and, of course, are not poisoned; whilst those intended for war (5 feet long) are pointed with human bone, barbed, and dipped in deadly poison.

At midday we reached Torotoram; but had to wade ashore, as on the previous occasion. Auta told us that from the day succeeding our departure in the steamer he had begun to expect the arrival of the promised teachers. He vacated his own house for their accommodation. We therefore landed the two appointed to Torotoram at once; not, however, without considerable fatigue, on account of the long sandbank in front of the village.

During this visit I took a more accurate view of their dwellings. Each domicile here, as at Katanu, is of great length, built on lofty piles, and provided at each gable-end with a wide verandah and a ladder. To peep into one is like looking through a railway tunnel—light appearing at the other end through a small door. The object in building on piles is for security against crocodiles, serpents, and the annual inundations. In the wet season the natives are compelled to go to their plantations on the higher ground in canoes.

Their houses are thatched with the leaves of the sago-palm. We climbed up a rough ladder in the largest in Torotoram. The front verandah would seat a dozen adults. The flooring throughout was of cabbage-palm. From the verandah a door opens into the interior, on both sides of which are slight partitions of bamboo, large enough to admit a man and his wife, who sleep on the bare boards. No door or screen exists. A rough fireplace of clay is allotted to every pair of cribs, for warmth and to drive away musquitos. Close to each berth is a shelf for tinder (bark of the *Melaleuca*) and firewood, which is also available as a sleeping-place for a young child. For the elder children there is no accommodation in the house. To the best of our judgment, there must have been inside this building accommodation for from sixty to eighty couples. The chiefs have houses of their own. In each Mauat village there are two large houses—one for boys, the other for girls. Elderly custodians are duly appointed to keep the inmates in order. This custom obtains on Saibai and Bampton Island (*Bārama*), proving those islanders to be colonies from "Little Daudāi."

One of our party walked into the bush at Katanu for 2 miles, among luxuriant plantations of bananas and taro. The country was almost a dead level; the soil of the richest description. It had been planned that we should penetrate into the interior at Torotoram to seek for a healthier location for our teachers. To our great

chagrin, the natives of this village would on no account allow us to leave the coast. Yet Auta had formally given permission. We endeavoured to buy over those who resolutely stood in our path; but to no purpose. They accepted our gifts, but still opposed our further progress, shouting, "Your feet will be bitten by serpents!" This was merely intended to deter us from pursuing the bush-path. We might roam along the intolerably hot, sandy beach as much as we liked. We afterwards learned that the women and children, with their treasures, were hidden in the very locality through which we had purposed to travel. In fact, only the fighting-men were seen by us at Katau and Torotoram on this, as on our previous visit to Mauat. The population of Katau may be estimated at 400; that of Torotoram at 500.

Some miles to the west of Mauat lies Baigo or Talbot Island. There is a considerable population at Baigo, all friendly to the teachers, who paid them a visit in a canoe from Tauan a few weeks before our arrival in the Straits. Several spears were hurled at the canoe at first, under the erroneous impression that it was a descent of their enemies. Kereseano and his companion were afterwards loaded with kind presents of food. The inhabitants of the mainland near Baigo are numerous, but by no means to be trusted. The drums of this district differ in form from those of Mauat.

#### \*THIRD VISIT TO NEW GUINEA.—REDSCAR BAY.

On Tuesday, November 19th, 1872, we hove anchor at Mer (Murray Island) for the eastern peninsula of New Guinea. We soon afterwards passed through Flinders Passage into the open Gulf of Papua, thus leaving awhile the most extensive coral-reef in the world, inside of which we had been sailing for two months.

On the 21st we sighted the lofty mountain range which forms the backbone of the peninsula—which in this respect strikingly differs from the low south-western coast. We passed a great number of palms drifting with the current, the stems and fronds literally covered with sea-birds. We were much pleased with the park-like appearance of Yule Island—clear, grassy spots alternating with picturesque clumps of trees. The island is 4 miles in length, and of considerable height.

We coasted along the mainland all that afternoon and night; and early on the following morning anchored in Redscar Bay, close to the islet of Varivara (the "Parivara" of the charts). A fishing-canoe, with five men, came alongside. With difficulty we induced some of them to come aboard. The canoe was far inferior to those

of Mauat. On a raised platform they had large jars of drinking-water, a bundle of arrows, and a fire to cook any fish they might catch. A few presents delighted them. Lowering the "Woolahra" mission-boat, we followed the canoe up the "Booria," a salt-water creek. A canoe full of natives happened to meet us. All but one old man instantly rushed ashore, and hid in the bushes. Fortunately we had one of our original visitors with us in our boat; so that on nearing the little hamlet of Kido—with about fifty inhabitants—the natives, though evidently trembling, did not attempt to run away from us. We found them busy preparing their breakfast. Some of the women were tending earthenware pots simmering over a slow fire; whilst others were scraping long mangrove fruits ere throwing them in. Another was nursing her naked babe, the remarkable appearance of whose skin surprised us. The mystery was soon afterwards solved by seeing a woman come in from the bush with her sleeping infant in a fine fishing-net suspended from her forehead—the child's face touching her right side, its toes her left! We laughed heartily at this ingenious contrivance. Another female reclined on the floor, and with her right foot rocked to sleep a nude boy of two or three summers, who lay coiled up in a coarse, long net, suspended from the opposite rafters of their miserable dwelling. After distributing a few gifts, we walked nearly a mile into the bush over a level, fertile soil. The few natives we saw were unarmed, and ran away at the sight of strangers.

On leaving Kido we wished to purchase a specimen of their pottery. Mr. Murray cut off a couple of red handkerchiefs for the purpose; but the sight of that gay colour drove them, like cattle, out of their senses. A general scrimmage began, the fair sex being the ringleaders, to get possession of these wonderful articles. By dint of firmness and good temper we pacified them by dividing the whole piece amongst the villagers. The Kido ladies gladly accepted the handkerchiefs, but declined to part with anything in return. It was evident, however, that we had won their good opinion, for they gave us a very hearty farewell in their own language.

We spent a couple of hours in investigating another salt-water creek, the "Nonoo River" of the charts. We fell in with a single family, fishing just inside Redscar Head. The man gave us to understand that they came from a village outside the bay, some distance to the south-east.

We now returned on board hungry and much discouraged, for we had been pulling about in the bay (which is 22 miles across) for

hours under a tropical sun with no better result than the discovery of a miserable hamlet, built in a mangrove swamp, where our teachers could not possibly live. Our real difficulty lay in the fact that we had no interpreter to elicit from the natives the information we required. Some Kido men had fortunately preceded us on board; from them the name *Manumanu* was repeatedly heard: but as they invariably pointed to the head of the bay, we concluded that it must be a long way off. We resolved to devote the following day to a search for this unknown village. Two extraordinary canoes, crowded with natives, bore down upon Varivara in the afternoon. Their appearance, in the distance, reminded us of paddle-steamers. They eventually anchored under Varivara, but took no notice of us. In all probability they were on a trading or fishing excursion to the Fishermen Islands. Several other great canoes came across the bay in the course of the evening, and, like the two former, took shelter under the islet. Bright fires were kept burning on their decks all night. At 3 A.M., the wind being favourable, they started afresh on their voyage—fires burning, drums beating, and weird figures dancing; but, unluckily, the wind fell light, and after the lapse of several hours they could easily have been overtaken by our boat. It was not until sunset that we lost sight of these unwieldy crafts, that at first had filled us with admiration.

Late in the day the Kido men were taken ashore. Amongst them was an old man who had received a complete suit of clothes. On landing he took up his little boy, who, not recognising the sire in his new rig, cried bitterly. It was not until the old fellow set down the child and laughed heartily that the boy discovered his mistake and dried up his tears. Next day we pulled ashore in search of *Manumanu*. We walked a considerable distance along the shore of this immense bay, crossing a salt-water creek designated "Manao River" in the charts. We were encouraged by meeting two or three natives, to whom we had previously given little presents. These introduced us to their companions, and smilingly led the way to the village we were in quest of. The first sure indication of our approach was a large enclosure of bananas. We now saw the mouth of *Manumanu* River, erroneously called the "Towton" in the Admiralty chart. The unnamed river to the north in the chart is the true "Towton," or, to spell it more correctly, the "Toutu."

*Manumanu* River is over a mile across at its mouth in November, which is the driest month of the year. A noble grove of coco-nut trees lined the opposite side of the river. A sharp bend brought us into a well-built village, consisting of a single long street. Delighted at the never-to-be-forgotten sight, we literally ran for joy into the

evidently populous settlement. Two chiefs, "Koko" and "Auā," met us and led us to a sort of council-house at the near end of the village facing the long street. We rested ourselves on the verandah, the interior of the house being filled with the notables of Manumanu, whilst the space in front was crowded with men, women, and children. The people seemed perfectly harmless, and were immensely pleased with their visitors.

We estimated the population of Manumanu at 900 or 1000. The village consists of ninety-four houses, all built on high stakes (higher than is usual at Katau and Torotoram). The houses are for the most part two-storied, whereas those at Mauat invariably consist of but a single storey. Everything was scrupulously clean. Swords of the saw-fish (*Pristis antiquorum*) were in several instances suspended in front of their houses as ornaments.

Our first impression of the Redscar Bay women was that they wore some tasteful close-fitting lace-like garment; but it proved to be merely the exquisitely beautiful tattooing with which they are covered. The men are but slightly tattooed on their faces and necks—exactly reversing what we had seen in Polynesia. The girdle of the men is made of the paper-mulberry, but is a mere pretence as a covering.

Especially were the women of Manumanu interested in the "Haine" (the captain's wife), who accompanied her husband on shore. Their evident fear at the first approach of our party now disappeared. We were permitted to wander about the village, to enter their dwellings, and to touch anything we pleased. A variety of little presents were made to conciliate them. Mrs. W.'s dress was carefully examined. Some of the Manumanu "ladies" tried hard to obtain part of it. One woman pertinaciously insisted upon her exchanging her wedding-ring for a common mussel-shell!

The universal occupation of the women of this village is the manufacture of red pottery. With great interest we watched the entire process, from the mixing of two kinds of clay to the slow baking of the ware, which had been for some days hardening in the sun.

The complexion of these people is nearly the same as that of the Samoans and Rarotongans. In stature and physical strength they are far inferior. In general the Manumanu natives are under the average height: some would be accounted dwarfs. Their features are good, and the expression agreeable. The men dress their hair in a peculiar fashion—tied up so as to form a mop or chignon. Over the forehead is worn a head-dress of large red cockatoo feathers, contrasting with another of short white cockatoo feathers close to the former. A white cowry shell is often worn on the forehead.

Long nasal ornaments are inserted in the septum, which is invariably pierced (in males) for the purpose. One foppish young man gloried in a nose-jewel curving outwardly, rendering the operation of kissing highly dangerous! The sailors nicknamed these nasal-ornaments "sprit-sail yards."

We saw no iron instruments in the hands of these natives : they did not even seem acquainted with the use of iron. A stone adze (of jade) was obtained in exchange for some red cloth. But when Joe tried to purchase a similar one for himself with some pieces of stout hoop-iron, the owner bluntly told him that the iron was useless, whilst their axes were *very good*. And really these adzes must be pretty serviceable, for on the verandah of one house we saw a long plank 38 inches in width! Several were 24 inches broad. These planks were beautifully smooth. What labour must have been expended in dubbing them out! The adzes were fastened to the handles with strips of rattan, and not, as in Eastern Polynesia, with sinnet. Neither the Mauat nor these Manumanu natives seem acquainted with the manufacture of that valuable article.

Suspended from the neck of males and females were small but beautifully-netted baskets, as a repository for valuables, not unlike the reticule of a European lady. This is sometimes worn in front, sometimes behind.

We came upon a matron preparing the household repast. She seemed in no degree disturbed by our curiosity, nor did she invite us to partake of her hospitality. The viands turned out of the great earthenware pots consisted of cooked yams and half a good-sized pig. An immense lizard, measuring upwards of four feet, was roasting on the live coals. It was cooked entire—claws, tail, and entrails! In every dwelling we found something stewing over a fire ; but after the sight of the green lizard, although very hungry, nothing would have induced us to taste the contents.

Numbers of women and girls were filling their jars with water to drink, close to the village, thus proving the river to be fresh half a mile from its mouth. Some gracefully poised these jars on the head, whilst others carried them on the hip. Nearly a score of canoes were moored to the shore. The natives told us that we were the first white folks that had ever entered their village, and that our boat was the first that ever entered Manumanu River.

At the farther extremity of the village the scene was enchanting. An island covered with timber divides the river into two principal branches. In the distance were magnificent ranges of cloud-capped mountains. From where we stood to the farthest shore was more than three miles, and this at the end of the dry season. What, then,

must be the volume of water poured down from] the interminable valleys of the interior during the rainy season!

On leaving, a great crowd of men, women, and children followed us to the boat. The little boys waded up to their armpits for a final shake of the hands with the wonderful "haine," *i.e.* lady. Most of them presented her with wooden dolls of their own rude manufacture.

A sandbank, with two fathoms of water on it, lies near the entrance to Manumanu River. A rush of discoloured water, near the northern shore of Redscar Bay, indicates the true entrance to the river. Beyond doubt, a vessel of light draught might go up to the village of Manumanu.

On Tuesday, November 26th, Captain W. and myself set off to explore Manumanu River. We started at 6 A.M., but did not reach the village till 8, the tide being against us. The teachers assured us that they had spent a comfortable night, undisturbed by natives, but that food was scarce. How different from the Mauat coast, where they loaded us with presents of food! A native begged of the writer a fragment of a coco-nut he had been eating.

Our object in calling at Manumanu was to obtain a pilot. An old man, with whom we had become very friendly, agreed to accompany us up the river. Our intention was to explore the principal channel, called by our guide the Veuru, but the old fellow earnestly dissuaded us from our purpose on account of some mysterious danger. Besides, he assured us that it would prove to be only an arm of the sea. To our subsequent regret we took our pilot's advice and pulled up the Wanaba, or eastern tributary, under the erroneous impression that the Veuru and the Wanaba would unite to form one noble river at the other side of the island. Ere this decision was arrived at, we had passed the Abesi on the left and the Mapu on the right.

As soon as Captain W. had finished carving the name (*Lælia*) of the yacht on a tree, we again started on our way, this time sailing pleasantly with a fair wind. The heat of the two preceding hours was sultry in the extreme, reminding me of days spent in the Gilbert Group just under the equator.

Flocks of wild ducks wonderingly gazed at us from long mud flats as we glided pleasantly along the Wanaba. Two islets, well-wooded, narrowed the course of the river. Farther on, the Mareva, a considerable stream, branched out in a southerly direction. The river now became much narrower, and was called by our good-natured pilot the Taribadi. For a long while after leaving the peaceful village where our teachers had found a home, we saw nothing but the everlasting mangrove. At length the southern

bank became comparatively open. It seemed to be lined with a dense grove of young coco-nut trees; but, on a closer approach, our wished-for coco-nut trees proved to be a gigantic species of palm, common throughout the Indian archipelago, but new to me. The fronds were nearly thirty feet in length, *i.e.* twice the length of a coco-nut frond; the fruit (I secured a specimen, weighing sixty pounds) closely resembled the fruit of the pandanus, only eight times larger. The flower, also, was gigantic. The leaves are identical with the well-known fronds of the coco-nut—the midrib perfectly similar. Yet the *Nipa fruticans* never attains to any considerable height: it grows only in wet localities. I had previously picked up a quantity of seeds at the mouth of Katau River, without seeing the tree that produced them. The long leaves of this palm, carefully split into fine shreds, furnish the grass-like petticoat of the women of Manumanu. The oily kernel, of the size of a filbert, is eaten in times of scarcity.

The river now changed its direction from north to east, so that we felt certain that we had lost all chance of reaching the foot of the near mountain range in sight from the village of Manumanu, and which had first suggested the excursion. The river evidently trended towards the "Owen Stanley," being probably one of the many streams derived from its base. We had not sufficient time to explore this river to its source. Our object was simply to seek out the natives, and, if possible, to discover a healthier site for a mission station. Although the banks of the river gradually rose, the country was evidently inundated in the wet season: hence the absence of population. In our mortification we at first resolved to return, as it would be a long and weary pull against the tide into the middle of Redscar Bay. Curiosity, however, induced us to go on a little further ere we returned, and well were we rewarded, for now the scenery became exquisitely beautiful. A great variety of trees grew, not too thickly, on either bank. Vines and creepers innumerable hung in graceful drapery from the loftiest branches. Overtopping all were what we at first mistook for ancient coco-nut trees—sure sign of human vicinage—upwards of 80 feet high: one had fallen across the river, ready to be borne into the ocean by the next freshet. Again we were doomed to disappointment, for it proved to be the *Kentia procera*, with its great clusters of berries for fruit, found in New Britain and other islands in the Indian Archipelago. On the opposite bank grew a strange-looking dwarfish palm, bearing fruit. Fan-palms raised their graceful heads here and there. A large vulture, with a white neck and a very disagreeable loud croak, soared high overhead. Hawks were in hot

pursuit of smaller birds that sought safety in the recesses of the forest. A tiny bird, at first mistaken for a large butterfly or moth, amused us by darting in and out of the long grass overhanging the river in search of insects. The hoarse voice of the cassowary was heard in the distance; and the cry of the cuckoo reminded us of home.

At 2° P.M. we camped on a high grassy bank hedged in by tall delicate tree-ferns, a leaf of which was as long as our boat. We were 7 miles from the river's mouth. The Taribadi was here 40 yards across, and 8 feet deep. Our camping-ground was very moist, apparently having but recently emerged from the great annual flooding. For some time our guide could not be induced to leave the boat, through fear of the "bulom," *i.e.* crocodile. We asked him the length of this dreaded foe: his measurement proved to be 30 feet. When at length the old guide saw us eating, hunger overcame fear, and he sat down with us to luncheon.

Our way home was pleasant, as we were in a great degree shaded from the rays of the hot afternoon's sun by the dense forest. We landed at Manumanu to say good-bye to the teachers. A number of stranger natives were pointed out to us: they had that day arrived in canoes from seven villages on the opposite side of the bay. All these villages are anxious to have teachers. Thus the object for which I had left the yacht early in the day was providentially realised after all. Excluding Kido, as being too insignificant, there are now in Redscar Bay alone no fewer than eight villages, with a probable population of some four or five thousand, open to the labours of the Christian evangelist.

An hour after sunset, guided by a lamp at the masthead, we got on board, and found that our friends had been anxious on our account. Another, and, to confess the truth, a *tearful* farewell in parting from the teachers who came to take back the boat, and we were ready to start at dawn for Bampton Island, near the entrance to the Fly River, on our return voyage. We had succeeded in landing teachers on the south-west and on the south-east coasts of New Guinea proper, at points somewhat more than 260 miles apart, and had met with only kind treatment from the natives.

It was nearly noon ere the wind favoured us on Wednesday, November 27th, 1872. As usual, we rose before the sun—this time in the hope of obtaining a farewell glimpse of the magnificent mountain range which forms the back-bone of the eastern peninsula. Two lower ranges intervene between it and the sea-coast. Mount Owen Stanley stood out in all its glory, 13,205 feet above the level of the sea—the impression upon the imagination being deepened

by the excessively low coast-line. But a little to the E.N.E. rises a still loftier mountain, the highest peak in a range at the back of the Owen Stanley. This magnificent mountain is some thousands of feet higher than Owen Stanley: but one cannot speak certainly as to its height, as a cloud invariably rested on its summit. At our first anchorage, our position was highly favourable for viewing it; but unfortunately, by moving into the middle of the bay, the yacht came in line with Owen Stanley. It is due to Captain Websdale to say that he first drew our attention to this majestic mountain; and thenceforward we daily looked for the occasional pleasure of admiring its solitary grandeur. It was not until the day of leaving that it occurred to any of us to sketch its form; but it was obscured in cloud. Mount Owen Stanley was distinctly visible; but its loftier companion behind was hidden in haze.

The eastern and western coasts of New Guinea are inhabited by races which differ in colour, language, the partial use of clothing, the chewing of the betel-nut, and in the treatment of their women. The women of Redscar Bay are by no means a down-trodden race.

We were interested in tracing a likeness between the dialect used by the Manumanu natives and the Rarotongan language. In the Hebrew, *consonants* are the essential part of the word; in the middle and eastern Polynesian dialects the consonants are constantly changing, the *vowels* being the essential part of these (if one may so express it) *invertebrate* languages:—

Manumanu.	Rarotongan.		A few other words radically different.
Haine	Vaine	Woman, wife.	Aniani
Wanua	Enua	Land.	Tapu
Hai	Ai	Fire.	Mauta
Mata	Mata	Eye.	È
E	E	Yes.	Eve
Io	Io	Yes.	Bulom
Aue	Aue	Alas!	Veti
Utu	Ngutu	Lip.	Maino
Imaima	Rimarima	Hand.	Ote
Taiā	Taringa	Ear.	Neki
Ada	Tangata	Man.	
Oroko	Oro mai	Come.	Forsake.
Urama	Kia ora na	Salutation.	

Where do the Papuan and Malayan races meet on New Guinea? We know that all the coast natives *west* of the Fly River are black, and that the Redscar natives are a light copper-coloured race. The point of contact, then, must be somewhere between the Fly River

and Redscar Bay.\* We saw one black man at Manumanu—a visitor from a village lying to the west—strangely contrasting with the crowd around him.

We saw no gold whatever in New Guinea; and feel inclined to disbelieve the stories about specks of the precious metal being seen in specimens of native pottery. A story of this kind, invented by sailors on board the *Surprise* a few months since, originated the disastrous *Maria* expedition. In the numerous specimens of New Guinea pottery we have examined, there were no indications whatever of gold. I filled a bottle with the sand used by the women in making earthenware. It was heavy and glittering; but has been pronounced by assayers of gold to be entirely destitute of minerals, being composed merely of pulverized shells. Nevertheless, I fully believe New Guinea to be rich in minerals, because it is in reality a mere extension of Australia. Little Daudai is separated from Great Daudai only by a shallow strait, which is continually traversed by canoes.†

Emboldened by our success, a small party sailed up to the village of Manumanu some weeks after our visit. They spent a week in exploring that neighbourhood: the result being the *certainty* that the arm we went up is the true river of Manumanu, the Veuru being only an arm of the sea. They penetrated about a mile further up the true river than we did, and saw in the distance a village; but were afraid to hold intercourse with the inhabitants. Their hopes of finding gold were entirely disappointed. They suffered greatly from intermittent fever, and were glad to get back to Somerset alive.

In regard to Bampton Island, the sad intelligence has just reached us that, despite their protestations of friendship, they murdered the entire missionary party shortly after our departure, and doubtless ate them. How little did we anticipate so melancholy a termination of our voyage!

Mr. MARKHAM prefaced the reading of the paper with the following remarks. The enormous island of New Guinea, which was nearly 1200 miles long, had remained an almost *terra incognita* since its discovery about 300 years ago. All that has been known was derived from the running surveys of D'Entre-

\* A recent letter from the Rev. A. W. Murray states that the dividing line on the south between the two races is the Manumanu River—all villages to the west being Negrito, and all villages to the east being Malay. This interesting fact satisfactorily explains the repugnance of our guide to permit us to visit the country west of Manumanu River.

† The dingo of Australia is doubtless derived from New Guinea, being found in all the intervening islands. In some of them (Mer, &c.) many are domesticated, but destructive packs roam in the bush.

casteaux, of Dumont D'Urville in the *Astrolabe*, and of Sir Edward Belcher in the *Sulphur*; but no one had ever penetrated into the interior, nor had there ever been very much communication with the natives. Yet it was known to be a country of wonderful interest, of magnificent ranges of mountains, and with a peculiar fauna. During the last year, however, much information had been obtained. Captain Moresby had succeeded in examining the country very carefully from Torres Straits to the extreme eastern end. He had made important geographical discoveries, and had had most satisfactory intercourse with the natives. He found that the Papuans, who had formerly been supposed to be the sole inhabitants, were only a portion of the population, and the people whom he had intercourse with were handsome savages of a Polynesian type, and of a very friendly disposition. The Rev. Mr. Gill (of the London Missionary Society), whose paper was then before them, had also visited the island, and a mission settlement had been established at Redscar Bay. Signori Beccari and De Albertis, the Italian naturalists, had explored the western extremity, and Dr. Meyer, a German naturalist, had completely examined the island of Jobie. The last-mentioned gentleman had also landed in the southern part of Geelvink Bay, and travelled across so far as the tops of the range of mountains, from whence he had a view of the ocean on the south side of New Guinea. Subsequently he paid a visit to the back of M'Clure's Inlet and crossed the isthmus. Such a journey had never been carried out before. He secured several valuable birds, many of which were new to science.

The PRESIDENT said that Captain Moresby bore a name well known among the hydrographers of the Indian Ocean, and from what they had heard that evening they might feel assured that he would well uphold the honour of his name and his profession. No part of the globe within the reach of English navigators was so little explored as the great island of New Guinea. It was between 1200 and 1300 miles in length, and had been known to Europeans from the days of the early Spanish and Portuguese discoverers down to the present day, yet until very lately the journals of those early discoverers and of men like Dampier contained almost all that was known about New Guinea. Later navigators had described an enormous island or collection of islands with great mountains, and an immense flat, alluvial country on the south, intersected with large streams which apparently belonged to some great river; but where the river rose, or what land it drained, and where was its principal mouth, were all unknown points. Even in late works on Ethnology the Papuans, or inhabitants of New Guinea, were generally classed as among the lowest type of humanity. Recent accounts, however, showed that, whatever was the case in the west of the island, certainly in the east, there was a large population presenting all the best features of the Melanesian races. They had probably been there for a very long time; for they were perfectly well settled, and cultivated the ground as old established inhabitants. They were not only a pleasant and agreeable people when first known, but Captain Moresby appeared to like them better the more he saw of them. It was highly probable that, when the country was better known, much would be learnt of the effects produced by climate and alterations of condition upon the great races of the earth. The Negrito races, which extended from the Andaman Islands down to Australia, met, in New Guinea, with the races of the Pacific, and wherever the line of demarcation was found, facts would be obtained of the greatest interest in the history of the human race. The people of New Guinea were actually going through the transition from the period when wooden and stone implements were used to the period when they were superseded by iron and metal. One part of Captain Moresby's paper must have touched the heart of every body present, namely that in which he spoke of the probable effects of the intercourse of these races with the English nation. It rested with the people of England to

make that intercourse either a great curse or a great blessing. The Rev. Mr. Gill (of the Church Missionary Society) had spent the greater part of his life in endeavouring among the natives of the Pacific to make it a blessing to them. His last work was to place a mission station on the south coast of New Guinea, and on his return to England sent his interesting paper to the Society.

Rev. Mr. M'FARLANE said that he had been appointed by the London Missionary Society, three years ago, to commence a Mission in New Guinea. The Mission had had intercourse with two distinct races—the Malayan and Papuan; the natives at Redscar Bay belonging to the Malayan race. Although the Papuans of New Guinea were superior to the natives of the islands in Torres Straits, they were inferior to the Papuans of the South Seas; while, on the other hand, the Malays of New Guinea were superior to any he had met with in the South Sea Islands. Politically, New Guinea was a place of considerable interest. It was only 80 miles across from Australia, and it would be most inconvenient for the colonists if New Guinea were in the possession of some foreign power with whom England might not, perhaps, be on friendly terms. The island was also important commercially. He had found not only a pearl fishery going on, but coal, and iron and gold. He was told by the natives that they often picked up nuggets in the beds of the streams after heavy rains, and he himself saw one. Ebony and canary-wood were plentiful, and the extensive ranges of hills must afford every variety of climate. Ague and fever were found all along the coast, but further inland, on the highlands no doubt, the districts were healthy. Botanists, naturalists, ethnologists, and conchologists were all interested in the island. The future of the natives must be either evangelisation or extermination. The only way to open up the resources of the country, and to make life and property secure, was to get the natives under Christian influence; for the experience of some of the South Sea Islands showed that civilisation could not precede evangelisation. By the kindness of a lady in Dundee, a small steamer, 83 feet by 15 feet, had been purchased; and in two months he was again going out to New Guinea, and hoped to be able to render some assistance in opening up the country and acquiring a knowledge of its geography. The Papuans had finely developed heads, and there was a perfect absence of anything like disease. They were generally about 5 feet 9 inches, or 5 feet 10 inches in height. Their hair was sometimes curly and crisp, and at other times more straight, but not so straight as that of the Malays.

Mr. R. H. PRANCE recommended that the Colonies of Australia, New Zealand, and Tasmania, should be formed into a Federation, similar to that of Canada, which would be sufficiently powerful to take Papua and Fiji under the British flag.

Sir CHARLES NICHOLSON considered that it was impossible to listen to the accounts which had been given of New Guinea without feeling that a great number of most important questions would soon demand solution at the hands of the Imperial Government. He fully participated in Captain Moresby's remarks with regard to the future of the natives of that island, and the results of the intercourse with the people of Australia. He dreaded very much the consequences of the contact of the two races, and believed that the only hope of a pacific solution of the difficulty lay in the introduction of Christianity. The Imperial Government ought not to ignore the question, for already a considerable pearl fishery was being established. It was found to be a most profitable one, and many enterprising Europeans were now employing Indian and native divers there. At Somerset (Cape York), a gentleman engaged in mercantile pursuits carried on a large trade with the natives of Torres Straits, exchanging the European products, which he obtained from Sydney and Brisbane, for the pearl shells collected by the islanders. The trade was increasing day by day, and was likely to become one of great importance; and unless precautions were taken in time, unscrupulous persons, reckless of all

consequences, would create quarrels with the natives, and bloodshed would ensue, as in the Fiji Islands. It had been suggested that the Australian Colonies should incorporate the Fiji Islands and New Guinea in one Federation; but if such a thing was done at all, it should be directly through the Imperial Government. It would, perhaps, be well to establish some sort of protectorate over the island without assuming territorial jurisdiction. Some person might be appointed as the protector of the natives, and to see that British subjects did not bring disgrace upon themselves and their country by their dealings with them. He did not, however, know that England was entitled to take possession of any part of the country. Captain Moresby had taken formal possession of Hayter Island in the name of the Queen, but it had not yet been stated whether the Government was prepared to confirm his assumption of dominion. For some centuries the Dutch had claimed the whole of the western part of the island, though there had been no formal declaration as to the meridian to which their claim extended. It was therefore desirable that, before any other steps were taken, the British Government should come to some understanding with the Dutch Government. He himself would be content to see the Dutch exercise authority over the whole of the island. They might then form settlements in different parts, such as at Moresby Harbour and Fairfax Bay, which appeared to be one of the most splendid harbours in the world. The bay was completely land-locked, with a minimum depth of 14 or 15 fathoms, so that vessels of any size might find refuge there.

The PRESIDENT, in conclusion, remarked it was now too late in the evening for them to consider the effect which Captain Moresby's discoveries might have on the China trade; but he would ask Sir Rutherford Alcock, whenever he had an opportunity of addressing the Society on the subject, to give some information with reference to the system of meteorological observations devised by Mr. Hart, by which it was hoped that navigators would get ample warning, at all ports, of those changes in the atmosphere which predict the cyclones and hurricanes which prove so fatal in those seas.

*Third Meeting, 8th December, 1873.*

SIR H. BARTLE E. FRERE, K.C.B., K.C.S.I., &c., PRESIDENT, in  
the Chair.

ELECTIONS.—*Russel Aitken, Esq.; William Alexander, Esq.; George A. Anstey, Esq.; Colonel Sir Frederick Arthur, Bart.; Captain Samuel Tudor Ashton (late 14th Hussars); Benjamin Barrett, Esq.; Edward Bibby, Esq.; Robert Blagden, Esq.; Theodore Carter, Esq.; Alexander Milne Dunlop, Esq.; Hon. Henry Evelyn Ellis; Colonel William Francis Grant; Robert Kaye Gray, Esq.; Colonel R. W. Harley, C.B.; Lord Hatherton; Richard Hewett, Esq.; Morgan Howard, Esq.; William Howard, Esq.; William Leslie, Esq.; A. P. Longbottom, Esq., C.E.; Colonel John Macdonald (Bengal Staff Corps); Thomas Cole Mackley, Esq.; Charles H. Marshall, Esq.; Colonel G. A. Maude; The Hon. Archibald Michie, Q.C.; Adolph Mosenthal, Esq.; His Excellency Count*

*Münster* (Ambassador of the German Empire); *George Henry Nelson, Esq.*; *F. H. S. Orpen, Esq.*; *James Dickson Park, Esq.*; *James Parker, Esq.*; *George Lewis Parkin, Esq.*; *Colonel Henry William Preedy*; *F. William Hutchinson Ramsay, Esq., M.D.*; *Captain William Fitzherbert Ruaxton, R.N.*; *John St. Clair, Esq.*; *George William Stow, Esq., F.G.S.*; *John Wrench Touse, Esq.*; *Edward Waltham, Esq.*; *Lieutenant-Colonel Thomas Smith Warden* (Bombay Staff Corps); *Henry Wellings, Esq.*; *P. Falconer Whytt, Esq.*; *G. Wood, Esq.*; *John Wills Allen Woodroffe, Esq.*

ACCESSIONS TO THE LIBRARY FROM NOVEMBER 24TH TO DECEMBER 8TH, 1873.—‘Die Stammverwandtschaft der Meisten Sprachen der Alten und Australischen Welt.’ Von D. E. D. Europaeus. Donor the author. ‘Die finnisch-ungarischen Sprachen und die Urheimath des Menschen geschlectes.’ Von D. E. Europaeus. Helsingfors. Donor the author. ‘Letter by Baron von Richthofen from Sining-fu, on the Rebellion in Kansu and Shensi.’ Shanghai, 1872. Donor the author. ‘Geological Report on the Upper Essequibo Rivers.’ By C. B. Brown. Demerara, 1871. ‘Currents and Surface Temperatures of the North Atlantic Ocean.’ London, 1872. Donors the Meteorological Committee.

ACCESSIONS TO THE MAP-ROOM SINCE THE LAST MEETING OF NOVEMBER 24TH, 1872.—A Map of the Ashantee War, showing the positions occupied by the Troops. Scale, 2 in.=1 mile. Presented by the Secretary of State for War. Admiralty Charts, 6 in number. Presented by the Hydrographer, Admiral G. H. Richards, c.b.

Their Royal Highnesses, the Prince of Wales and the Duke of Edinburgh, were present at this evening's meeting, and an unusually large number of Fellows and their friends were assembled, to welcome back from the Nile Sir Samuel Baker, and to hear his discourse, entitled—

*The Khedive of Egypt's Expedition to Central Africa.*

By SIR S. W. BAKER.

In introducing Sir Samuel Baker to the Meeting, the PRESIDENT spoke as follows:—

Your Royal Highness, Ladies and Gentlemen, Fellows of the Royal Geographical Society: On an occasion like the present we feel somewhat as our ancestors must have felt when welcoming home from regions which were theirs by right of discovery or conquest one of their fellow-Englishmen. But we have not only to give a welcome to Sir Samuel Baker; we have also to hear from him those details of the countries which he visited, which are to us, at present, simply matters of distant rumour. Without further preface, I will, therefore, ask Sir Samuel Baker to give us an account, or as much as he can describe within the short limits of the meeting, of what he has seen, and heard, and done in the regions of the Upper Nile.

Sir SAMUEL BAKER then addressed the Meeting :—

Your Royal Highness, Sir Bartle Frere, Members of the Royal Geographical Society: After an absence of between four and five years, I return again to this Society with mingled feelings of regret and pleasure; of pleasure, at seeing around me so many friends who have given me this kind welcome; of deep regret, at missing so many faces that in the short space of five years have disappeared from our midst. Among those faces the one most dear to me was that of the father of our Society, Sir Roderick Murchison. Many, many times when I have all but despaired amidst the difficulties that surrounded me I have looked forward to seeing him some day and obtaining his approval, as my great reward. But with this lament is coupled some satisfaction at finding that so great a loss has been so well repaired by the election of his able successors, Sir Henry Rawlinson and Sir Bartle Frere.

I will now proceed to give, in as graphic and concise a manner as I can, a narrative of all that has passed from the commencement to the end of my late expedition. But before I commence it is of great importance that every one should know what was the real meaning and intention of the Viceroy of Egypt in undertaking this great enterprise. In the countries beyond the pale of authority in the Upper Nile—that is, in Central Africa—there were between 10,000 [and] 15,000 slave-hunters, people who were mere outcasts from the miserable society of the Arabs of the Soudan. These men, instead of cultivating the land and following some honest industry, had adopted the nefarious business of kidnapping women and children in the upper countries. Now the Viceroy had heard of this crying evil, through his consuls, and more especially through myself, after my return from my journey in those parts, and, in the interests of humanity, he was determined to put it down. The question, however, was, how to put down so great an evil, and one which had existed from time immemorial. I had received a communication on this subject from the Khedive's minister, Nubar Pasha, just before I had the honour of being invited to accompany their Royal Highnesses the Prince and Princess of Wales on a tour in Egypt. On the arrival of His Royal Highness in Egypt, he, having heard from myself and also from others of the iniquitous slave-trade that was carried on in the Upper Nile, having also conversed with the Khedive on the same subject, with the sympathy and the kindness of heart which he is so well known to possess, interested himself most deeply in the subject. I can safely say that, although I might have had the command of the

Expedition offered to me, I am sure I should never have accepted it had it not been for the kindness of His Royal Highness, and the great interest he showed in its main object—the suppression of the slave-trade. It was by the advice, and I may say by the kind personal interference, of His Royal Highness that the arrangements were made with the Viceroy, and that I accepted the command. Therefore, throughout the Expedition, I not only felt perfectly certain that the English public would regard the undertaking with interest, as carrying out what had always been the great aim of England, freedom and liberty for every human being; but I also trusted that I should not disgrace my royal patron.

It was of course necessary to make the most complete arrangements. The Viceroy, first of all, wished to found a great Empire in Central Africa. He desired to suppress the slave-trade, and the annexation of the country was the first step necessary to accomplish that object. A military force was therefore required, and I was to start with 1700 men, including cavalry and the different arms necessary. But you must recollect that the Viceroy is, in Egypt, a man a century in advance of his age—a man of high intelligence and European ideas. The progressive principle in Egypt is indeed represented by only three persons, the Viceroy himself and two of his ministers, Nubar Pasha and Cherif Pasha. Thus, when he undertook the grand reform to which we are alluding, he placed himself in direct opposition to the most ancient institutions of his country. He, as one man, supported by two ministers, was in fact going against all Egypt. I therefore found myself in the unenviable position of being a Christian in command of two or three Mohammedan regiments, appointed to put down a most cherished Mohammedan institution. You may readily imagine that, however anxious the Viceroy was to do his duty, and however sincere he was, the expedition was sure to be thwarted by every intrigue that could possibly be used.

I started with a European staff, composed of Lieutenant J. A. Baker, R.N. (my young nephew); Mr. Higginbotham, a most able engineer; six mechanics from Samuda and Penn's yards; Dr. Joseph Gedge, chief medical officer of the Expedition, and Signor Marco-polo, who had the entire charge of the *matériel*.

Some delay at the outset was occasioned by the opening of the Suez Canal, and that delay was favourable to the intrigues of the slave-hunters at Khartoum; for when I arrived there I found that the officers who had been sent forward with the regiments had fraternised with the masters of the slave-hunters; it was, in fact, preconcerted that the expedition should fail. At first there was a

difficulty in getting vessels, but in course of time all difficulties were surmounted, and I started with 800 men.

On my arrival at latitude  $9^{\circ} 21'$ , I found that an enormous and terrible change had come over the River Nile. Instead of the grand, broad stream which waters Egypt, I found at this point nothing but immense marshes. The Nile had entirely disappeared, in a manner almost incredible. Looking up the river, neither land nor water was to be seen; nothing, so far as the eye could reach, but an unbroken marsh. Near this point, however, a branch of the Nile, called the Bahr-el-Giraffe, enters the main river, and the slave-hunters had pushed their light vessels (which carried no merchandise but many men, some upwards of 100) through that channel, and over all obstacles, to the open water of the Upper Nile, far above the obstruction; but they generally took six months on the journey. The region beyond this horrible vegetable obstruction was cut off from all law and authority, and was thereby admirably adapted for piracy. It was so late in the season when we arrived that I found it would be impossible to cut our way through the Giraffe branch before the rainy season commenced. We did cut through about 32 miles, but with a loss of more than 100 men, and the rain then fell in torrents, so that it was absolutely necessary to return. I would not, however, return to Khartoum, as I knew that if I did intrigues would be set going that would be likely to ruin the Expedition. I returned as far as the mouth of the Sobat, and formed a camp there. The retreat appeared to be a most unfortunate one, but in reality it was a most fortunate circumstance, because none of the slave-hunters knew that I had formed a station there: they thought I had gone back to Khartoum, and in a short time down came the fleets of boats laden with slaves, and of course they all fell into my hands. I released a great many slaves, and put the captains of the vessels in irons and sent them down to Khartoum.

The following year I started again, with an increased force of 1200 men, and with all sorts of instruments for cutting through the obstructions. We worked for four months in nothing but mud and slush and tangled vegetation, succeeding at last in dragging through the steamer of 32-horse power and 100 feet long, and a fleet of vessels of 50 or 60 tons each, with 1500 men, including officers, soldiers and boatmen. We dragged the whole of the flotilla through until we regained the Nile above.

When I reached Gondokoro, in latitude  $5^{\circ}$ , I found that the slave-hunters had been there the year before, and had had time to foment intrigues and to incite all the tribes against us. Instead, therefore, of meeting friends we encountered many enemies. Now it may

appear to people who have had no experience, that a person going out from England would meet with a grand reception from the natives if they knew he had come to suppress the slave-trade; but, unfortunately, those gentlemen who lecture at Exeter Hall about "a man and a brother" know very little about it. "A man and a brother" will invariably, if he can, enslave his fellow man and brother. When I was travelling up the Nile, after cutting through the obstructions, I felt somewhat between a general and a missionary, and when I landed I of course made friends with the native chiefs, and tried to interest them in the object of the mission. There was one chief, a very intelligent man, with whom I had a long talk under a tree: in fact, I almost preached him a sermon upon the abolition of the slave-trade, explaining to him how horrible it was that people should be bought and sold like cattle, and the man appeared extremely touched. Now you must know that in those countries on the borders of the Nile there is no iron or other metal; every implement is made of hard wood; even the arrows are pointed with hard wood; and any piece of iron has an extreme value, but the most valuable is a piece shaped exactly like the ace of spades. It may almost be called the money of the country, for you can purchase anything with it. Well, after I had given a long lecture to this chief on the abomination of the slave-trade and the horror of buying and selling children, he asked me, "Have you got a son with you?" "No," I said; "unfortunately I have not." "I have," he said; "I have got a charming boy, about so high. He is very thin now, but he is always hungry, and if he could stop with you, he would eat from morning to night, and so in a short time grow enormously fat. He is a dear boy; I'll sell him to you for a spade." Here I had got the real knave of spades. The son was always hungry, eating from morning to night, and so he was to be sold to me, when the expedition was all but starving. That little incident will give you a notion of the obtuseness of these people. They listen to nothing. They do not believe in any horror of the slave-trade at all, provided their own women and children are not kidnapped. They do not believe in you unless you will assist them to steal somebody else's cattle or to kidnap somebody else's children. It is a delusion, therefore, to believe in the virtues of these negroes, for the description I have given applies to all the tribes I have been among. This greatly increased our difficulties, because I had not only to repress the slave-trade but to reform the whole character of the inhabitants of Central Africa.

I founded a station at Gondokoro, and shortly afterwards the Bari war broke out. These Bari people, the most warlike in

Central Africa, had for many years been allied with the slave-hunters in pillaging the other tribes in the interior. When, therefore, regular government was established by us, it was naturally opposed to the interests of the natives themselves; for they could no longer join with the slave-hunters in pillaging. It was necessary to establish order where the population lived in disorder, and it was also necessary to travel onward, for every tribe wished to war against the other. In a very short time we were plunged into the Bari war. I will not detain you by any description of that war. I dare say it was not so bad as the Ashantee war. I really do not know, but it was a difficult affair, with constant bush fighting. In the course of two months, however, the Baris were entirely subdued. Then, unfortunately, a spirit of discontent arose among my troops, and the officers again conspired to ruin the expedition. The Baris had been beaten in every fight, with a very trifling loss on our side; but this did not conciliate my troops. One evening, about 9 o'clock, some very large letters were placed in my hands, looking very suspicious. I would not open them that night, for I was sure something was going wrong; but on the following morning I found that a conspiracy had been formed among the officers, the lieutenant-colonels included; and the full colonels in command of the troops declared that they must abandon the expedition and return, beaten, to Khartoum. Now that was the most difficult position I ever felt myself in. Danger, most people can get over; but here was treason and conspiracy, and I had not a single man to rely upon. This trying occasion brought out the valour and constancy of my own countrymen. They were very few in number. My nephew was an officer in the Navy—of course there was no question about him; but we had with us mechanics from Samuda's yard and Penn's yard; and there was also a most able engineer. All were unanimous in declaring, "We will never go back; let them all return to Khartoum if they will; if we have to die here, we will die; they shall never say the English people deserted you." But the question was, What could be done? because it is all very well to talk of dying; most people can manage that. The question was, How were we to get on? Well, I thought the best thing to be done under the circumstances was to take no notice whatever of the Egyptian officers' letters; and so I gave orders that six companies should be under arms at midnight, ready for an attack on the Baris. That little change in the train of ideas saved the expedition. If I had written a letter in reply I should have been lost. That would have afforded plenty of *time for them to breed a mutiny*; but the sudden order to have six

companies under arms at midnight saved the expedition. We attacked the Baris on the south, and in about twenty days gathered sufficient corn from the Bari granaries to last the force nearly six months. This took place at a time when we were nearly starving.

The question then arose, how to get farther into the interior. I had three steamers brought up the Nile, in sections, built by Samuda and Company, with beautiful engines by Penn; but unfortunately there were no railways there, and we had no camels and not a single beast of burden. In the state in which we found the Nile, so closed up by vegetation, it was perfectly impossible to bring the camels from Khartoum. We thus had to contend with accumulating difficulties. We had met enemies and had beaten them; intrigues had arisen, and they were overcome; but we were at last conquered by the question, Who should carry the hat-box? We could not move. No native would give us a lift with any luggage, and we had an enormous mass of material without any possibility of moving it. Now, fortunately for me, I had the experience of my former journey, and knew that beyond the Bari frontier there was a tribe called the Loboré, who were carriers, and who for the payment of a cow per man would always take a heavy load. I therefore started for their country with 100 men, a herd of cattle and a few boatmen, just carrying a change of clothing for Lady Baker, my nephew and myself. We travelled through a populous and beautiful country—a country formerly traversed by Captains Speke and Grant, and by myself. I had supposed, with our small force, that we should of course be attacked in a populous country like this, inhabited by a most warlike people; but whenever I went to a village of an evening, I called the natives together and explained to them that I should feed upon them, but that at the same time I should pay them for what I had. On the following morning I left a cow or two as a present, and in that way we passed through the whole country without firing a shot. The people were exceedingly obliged for the payment, to which they were quite unaccustomed. I collected 500 carriers, and sent them with 50 soldiers down to Gondokoro. They brought up 500 loads of merchandise and everything that was required, and in that way we pursued our march until we came to Fatiko, on the third parallel of north latitude.

When we arrived at Fatiko we found the Paradise of Africa. The country is situated among the mountains, at an elevation of about 4000 feet above the sea. The average temperature is about 78° or 76°. The rainy season lasts about nine months, but the rain does not fall every day. Six or seven days sometimes succeed each

other without rain, and then follows a very heavy shower; in fact, it is just like a very fine English July. The soil is beautifully fertile; there are most lovely timber trees; game of all kinds is plentiful; and, above all, the population is most docile. I had been in the country years before, and when I arrived I found that many parts which I had formerly seen most flourishing had been entirely devastated by those rascally slave-hunters. Whole villages had been burnt, and for 84 miles we passed through a country without a single inhabitant, whereas I recollect that years ago there was a teeming population there. This population was now gone. When I arrived at Fatiko, I found that the slave-hunters had a very large station there, standing on about 30 acres; that they had another 22 miles distant, another 20 miles from that, another at the same distance from that, and so on; and that in those stations there were about 1100 armed men, organised after an irregular military fashion, with flags and drums, a few cannon, and so on. These people had entirely destroyed the greater portion of the country. Now, with the orders I had received from the Viceroy, the question was, How was I to suppress the slave-trade? Under the circumstances, I thought that the best thing that could be done was simply to give them notice to quit the country by a certain day. I did not take the slaves from them, for I should not have known what to do with them. I could not have fed them, for there were thousands and thousands. I found that the arch-ruffian of the whole country had made some arrangement with the Governor in Khartoum, and that he was at the head of about 2500 armed slave-hunters, 1100 of whom were in this one district; that he incited every tribe against the Government, and told them that they were to assassinate me, if they possibly could. He had gone on to the country of Kamrasi, which I had formerly visited, long before the slave-hunters had ever been there, and he incited the son of Kamrasi (Kamrasi being dead) to assassinate me if I should ever arrive in his country, promising that his slave-hunters should attack the troops on my arrival at Fatiko, and endeavour to create a tumult; but the natives, who remembered my former visit, refused to attack. We shortly became the greatest of friends, and when I explained that the slave-hunting was at an end, and that the Government would protect them, the whole country declared their allegiance to the Government. Now it is all very well to give protection, provided you have sufficient force, but after the conspiracy of the officers, 600 men out of my 1100 (for 100 were dead) had gone back to Khartoum. I was therefore left at Gondokoro with only 500 men to carry out the whole of the Viceroy's instructions. I had to annex Central Africa and suppress the slave-trade

with 500 men. I had started from Gondokoro with only 200 men, leaving 300 in the fortified camp there ; so that, although the people at Fatiko declared their allegiance to the Government and I had promised to protect them, there were, forsooth, only 200 men for their protection, and there were 1100 slave-hunters who could pillage at discretion. However, I left 100 men in a little camp close to the slave-hunters' camp, to represent the Government and to overawe them, so that if they continued to massacre or kidnap the women and children I should hear of it from the reports of the commandant.

I then continued my journey to my old country Minyoro. On my arrival there I found that the head-ruffian had not only passed through, but had been to Masindi, the capital of the country, and had made preparations for our murder if we arrived there. He had a station on the banks of the Nile, at Kuruma Falls. The man who commanded that station of slave-hunters, though pretending allegiance to the Government, actually, with his own hand, murdered a man to whom I had given protection. I could only give him 200 lashes (I did not like to shoot him), put him in irons, and take him prisoner. When I arrived at Masindi, which is only one day's journey from the Albert Nyanza, I found a population of about 8000 men with the king, but these 8000 men appeared to be all bachelors, for there was not a single woman amongst them, and that is the very worst sign amongst natives. If you see many women and children it means peace, but if there are many men without women or children it generally means hostility. Those people are celebrated for treachery, and they certainly deceived me. I had taken with me many things to establish trade. I explained the wishes of the Viceroy to them ; I hoisted the Viceroy's flag, and formally annexed the country. Every day men came in with elephant tusks, which they sold for a few beads, and everything seemed as prosperous as possible. I had driven the slave-hunters out of the country, and the people appeared perfectly content. But this was merely treachery. The king prevailed upon me to call up from Fatiko the whole of the men I had left there, with the merchandise and ammunition, and he offered to supply 300 carriers to accompany ten of my men if I would send them to Fatiko, 160 miles distant. I wished to concentrate my little force, which would then number 200, and I started off eleven men with some of the slave-hunters' people, with a letter for the commandant, telling him to come to me with his men and all the merchandise and ammunition, intending to form one large camp at Masindi, from which point I should be able to explore the Albert Nyanza. Now it was

a very great mercy that I did not go to the Albert Nyanza. Eleven of my men started with twenty-five slave-hunters, who formed the irregular force of the Government, and with 300 native carriers. These 300 native carriers unfortunately, or fortunately for me, attacked my men before they got to Fatiko. Their intention at first was to get the men from Fatiko, with all the merchandise, close to the river, and then to murder them while asleep in the grass. I knew nothing of this, and believed them to be perfectly friendly. My men had been gone about fifteen days, when one evening, while we were at dinner, the sheikh sent me seven large jars of what they call plantain cider. The troops were very fond of the cider, and I immediately sent it to them: but hardly five minutes had elapsed when the colonel who commanded them rushed frantically into my room and said, 'The troops are all poisoned.' Fortunately I had a small medicine-chest containing everything necessary, and I gave them as much emetic as I possibly could, but there were about forty of them lying down with constriction of the throat; delirious, and some of them perfectly insensible. That night the guards were doubled; but the night passed without any sound whatever. Generally speaking, at night there was singing and drumming till the morning, but that night there was perfect silence. On the following morning, before daybreak, I was walking up the approach, for our place was very well laid out, just like an English garden, and I sent the men to call the sheikh, the chief of the district, to explain to me what had happened the evening before. The men had hardly gone into the village (we being in the centre of it), when I heard shouts and yells from thousands of savages, followed quickly by two shots. It was capitally organised. There were about 7000 or 8000 of these fellows, perhaps about 50 of them armed with guns, concealed in the very high grass that surrounded the place, and a sharp musketry fire opened on the troops. Fortunately the bugler was at hand. He sounded the alarm; and the men, being well drilled, protected the camp immediately. The battle lasted about an hour and a half. Having rockets and blue-lights, we were enabled to set fire to the town on the right and left flanks, so as to protect our flanks, and the fifty body-guards, armed with Snider rifles, which on several occasions entirely saved the Expedition, charged into the town. The enemy suffered tremendous loss, and in an hour and a half the whole town was totally destroyed. Unfortunately the king escaped. Now this fellow, although young, was a notorious character. He had murdered the whole of his family. When his father died he went through the funeral rites; but these require to be explained.

When the king of that country dies—for I may tell you it is a highly-civilised country, and really was a kingdom—a framework is made like a huge gridiron or an iron bedstead. The king is laid on it, a small fire is lighted underneath, and he lies there until he becomes roasted, or like a very burnt-up hare, which we unfortunately see too often on the table. He is then wrapt up in cloths, and lies in state. But the completion of the roasting is the signal for civil discord, and the sons, no matter how many there are, immediately fight for the crown. This civil war may last any length of time; but at last, when one son is victorious he goes to his father's body and sticks his spear into the ground, as a symbol of victory, as though he said, "I have conquered and am here." Then the funeral takes place. It partially resembles some of the old Scythian rites, and corresponds exactly with what is described as being the custom 500 years ago in China. An immense pit is dug, capable of holding some hundred persons. It is lined with cloths, some of the wives sitting at the bottom, and the king's body is lowered down. During the night preceding this ceremony the soldiers surround certain huts, at discretion, and catch as many people as they can. On the following morning they take them to the side of the pit, break their arms and their legs below the knees, and then throw them in indiscriminately, alive, on the top of the wives and the body of the king. The pit is filled up as far as possible with these writhing people, sufficient space being allowed for the earth, and then the frantic crowd throw the earth in, and jump and shout and dance upon it until they have stamped the whole down. That is the burial of the king. But then there is a chivalrous idea with regard to the son. Before he can be throned as the monarch of the country he has to cross the Victoria Nile, and sleep one night on the east side, because, sixteen generations ago, the Gallas, from whom the kings are descended, attacked Minyoro from the east and conquered it. Therefore, before he is throned, he sleeps one night on the east side. On the following morning, with his followers behind him, he steps upon the old path of his ancestors, marches to the river, and sticks his spear on the opposite bank as a conqueror. This being the last rite, he is crowned king.

Well, this young king, having triumphed in that way, thought the best thing he could do to prevent civil discord and family dissension was to kill all his relations. So he invited them to some festival, and gave orders that as they were going away they were to be murdered. He had now, as I have described, attempted to get rid of me.

The battle of Masindi was very creditable to my few men. They behaved remarkably well, and with very great steadiness; but on the following morning there was this difficulty: this large town, which was composed of some 8000 or 10,000 houses, was utterly destroyed; there was nothing but smoking ashes left. We were in a little spot where I really fancied I was laying the foundations of civilization. I had a beautiful English garden, stocked with English vegetables: there was the house with the Government flag flying; but we were now in the very midst of desolation. It was a very difficult thing to know what to do. The enemy had been beaten, but I knew perfectly well that the population numbered some millions, and I felt quite certain that unless we could make peace we should be again treacherously attacked by an enormous force. I knew also that if we were constantly subject to night attacks our ammunition would be wasted until at last we should be helpless. I therefore came to the conclusion that the best thing to be done, under the circumstances, would be to march to the old enemy of the country, Rionga, and place him on the throne. Now, Rionga was a powerful chief at one time, and was always the great enemy of Kamrasi. When Speke and Grant passed through the country they were bothered night and day by Kamrasi to assist him in attacking Rionga. They, as English gentlemen, of course refused. When I visited the country many years ago, Kamrasi every day determined that he would attack Rionga; but I refused to assist him. They say, "Cast thy bread upon the waters, and it shall return unto thee after many days;" and I think it is sometimes right. Rionga heard of this, and he heard also (for he had his spies there) that we had been deceived and attacked treacherously. He also heard that I was on the march to him. But the question with me was, how to march? We had no guide: the country was nothing but a forest of grass, nine or ten feet high; it was the rainy season; it was 93 miles from Masindi to Rionga; and the question was, how to march 100 men through an enemy's country, through the most frightful jungle ever seen? I can safely say I had serious misgivings. I made up my mind that very few of us would ever arrive there; but at the same time it was absolute madness to remain. We had no provisions, except a few bags of flour, just sufficient to last four or five days, and it was absolutely necessary to act without the slightest delay. I determined to destroy all that we could not carry, and gave the order that each man was to carry as much as he could. Thank goodness I had those Snider rifles and a picked corps of men. My march was organised in the following manner:—Fifteen Snider rifles, with a bugler,

formed the advanced guard, under the command of the colonel, who was a most excellent officer; then I followed with Lady Baker and my nephew, and the ammunition, and ten Sniders, and a bugler; and the rear-guard was commanded by a captain, a very good officer, who had fifteen Sniders. The few other Sniders were interspersed among the line, who were armed only with muskets. Every man, except the advanced guard, the ammunition guard, and the rear-guard, carried a heavy load. They had to carry the whole of the ammunition in bags, which weighed 62 lbs. each. At the same time I was perfectly certain that we should have to fight every day of the march. These simple arrangements were all that could be made, and I directed that the men should only keep the length of one man apart, so that the line should not be cut through. They were to keep profound silence throughout the whole of the march. In this manner we started. I had made arrangements to set fire to the station and to burn all the effects, so that the natives should not plunder the camp and boast that they had taken it by storm. The first day of our march it rained from morning to night,—a perfectizzle. Everybody was wet through. We were driving seventy head of cattle, and they wandered in all directions in the grass. We lost one man, and in the evening we could obtain no water. We had to cut down trees to make a fence in case of a night attack, and everybody, in fact, was miserable. On the following morning, when we started, I gave orders to allow the cattle to run where they would, and we were in the most difficult position for fighting that can possibly be conceived. I can safely say I never saw one of the enemy, except dead, though we were fighting seven days. Of course the troops had to march in single file. The path was certainly not more than six or eight inches wide, and the grass was so dense that if you put your hand into it, you lost sight of it. Now the natives have a method of ambuscade which is very serious. At about three feet from the path they cut large clear spaces, in which, perhaps, a thousand men may be concealed. The grass conceals them like a curtain. On the other side there may be another space cut, and perhaps there may be 20,000 men on your line of march, and you may not be aware that there is a soul in the country. As the troops march along, keeping profound silence, the first intimation you have of an attack is a peculiar whistle, imitating the cry of a particular bird. Whenever we heard that whistle lances immediately came across the path, from right to left and from left to right, and of course the troops had to open fire, the alternate men facing right and left. In this way we fought for seven days, losing very few men, but having thirty wounded,

until we arrived at Rionga. I often look back on the events of that march, although I had very little to do except directing my little force. No men ever behaved in a more admirable way. They had nothing to eat, but though they were black men they had such confidence in me and my officers that they were perfectly obedient.

When we arrived at Rionga, I, of course, found an ally. Then we went through the ceremony of exchanging blood; but it is not the disgusting ceremony I had expected. He just pricked his arm with a lancet; you prick yours. He just puts his lips to your wound, and you put yours to his; and the whole thing is settled. That is a kind of Freemasonry among the natives, and I really believe, although I am not a Mason myself, that they attach much more importance to their Freemasonry than we do to ours, because Freemasons do quarrel now and then; but these men never do. If they exchange blood, they are allies till death; so that the moment I had gone through this unpleasant rite, I found not only that I had an ally, but that I belonged to the family.

My men, being in very great need of rest, built a stockade close to the river, and we remained there a few days until I could get from my new ally sufficient men to carry me to Fatiko. I thanked God that I had brought my men down safe. I formed an alliance with Rionga, and with the surrounding tribes, so that I had an immense force, and could walk over the country if I chose. I placed Rionga on the throne and proclaimed him king. I placed thirty men and the colonel in the stockade, and then started with Lady Baker and Lieutenant Baker and forty men to Fatiko, to see what had become of the unfortunate commandant, who I fully expected had been murdered with the whole of his troops. That was the most trying part of the expedition, because if he had been murdered we must have been likewise. It would have been quite impossible to retreat through the slave country with such a small force as I had with me. Fortunately, as I have described, the people, who had instructions from the king to march to Fatiko, and bring the luggage and men to the river, and murder them in the night, wished to retreat themselves, and so killed eleven of my men, and forsook them; and the remainder, after incredible sufferings, and nearly dead with hunger, reached Fatiko, and told their brothers the whole of the circumstances. They knew then that I must be attacked, and they all considered that I was dead. That, I think, was the foundation of the report that came to England some months ago. We had gone through a great deal of trouble (as you may imagine), which is all forgotten now; but still at the time it was very severe. For many, many nights, we had

no bed—nothing to sleep upon. My wife had to sleep upon the grass, cut down and soaked with a heavy dew like rain. We had no meat of any description for twenty-three days—nothing but wild vegetables, which we collected, and wild plantains which we boiled, and which formed but a poor substitute for potatoes. In this way we struggled on, thank God, in good health, without a sick man. The soldiers were strong, and we ourselves were strong, but very hungry.

I started to go to Fatiko with forty men; and I must tell you that Lady Baker had to march on foot the whole way. Just as I crossed the river on the road to Fatiko I met some natives, and immediately thought they were enemies, as we had done nothing but fight for so long. Half the soldiers had crossed the river, and I sounded the bugle to alarm them; but directly the bugle was blown, these men shouted out, "Is that the Pasha? Is that the Pasha?" "Yes," said my men. "Oh," they said, "that is right: we have come from Fatiko." "Is he here?" "No, he is at Fatiko; but all the slave-hunters are going to attack him, because they think you are dead." Well, it seemed ridiculous. We were no sooner out of one trouble than we were into another; and now, having won every victory and gone through incredible hardships, just as I hoped to get things into order, I heard that he was certainly not murdered, but was going to be, which was much the same. I pushed on with my forty men only, but they were good ones—the *élite* of the whole army, armed with Sniders. I had taken great pains to teach these men to shoot, and altogether they were as good fellows as I ever wish to command. It was 78 miles to Fatiko, and we arrived there at half-past nine o'clock on the morning of the 1st of August. No sooner was the bugle blown and the men turned out to meet me—and they were delighted, as they had heard, as you in England did, that we were all massacred—than I inspected the troops. We then had 140 men; 100 who had been left at Fatiko, and the forty that I had brought. The slave-hunters had been endeavouring to incite the whole tribe against us; but had entirely failed. The natives had noticed the difference between the Government soldiers and officers who paid for everything, and these rascals who kidnapped their women and children, and took away their cattle and destroyed their country, and they had remained true to the Government, although they saw that the Government was weak. In my absence, these slave-hunters had not only kidnapped, but had murdered the women out of spite to the natives, because they declared their allegiance to myself. They burned most of the villages and utterly destroyed this magnificent country, simply

because the natives were loyal. Still the natives said, "No, we will suffer; but we will cling to the Pasha; we will cling to the Government." When I arrived, a number of natives had followed from the native villages, because they wished to see if the Government was stronger than these slave-hunters, whose camp was close to them. No sooner had I turned out the soldiers and inspected them, than those fellows turned out theirs. They had 270, with nine flags, and everything in military order; but I could not conceive that they would have the audacity to attack the troops, because 140 disciplined men, I consider, ought to be a match for 270 irregulars. But no sooner had the troops retired into camp, than in the most treacherous manner these fellows poured a most withering volley into them from about ninety yards' distance. My men were all dressed in scarlet, so they offered an excellent mark, and six or seven fell immediately. We should have suffered very great loss, no doubt, but I sounded the advance, led the men out, and of course completely crushed the enemy.

That day, I may say, completed the work of the expedition. The natives had heard the boasting of these men: they had heard that I was dead, and, as they described it, they saw me suddenly spring out of the grass. They saw these people attack the troops and the troops walk over them with the bayonet; and if I had lifted up my hand 500 natives would have joined the Government. Our troops killed 141 on the spot. There were 270 at the commencement, so there is no doubt the Snider rifle had had a most terrible effect. It only shows, I think, that in almost any expedition, if it is necessary to use force, it should be used in the most unflinching manner. But the difficulty was this: from that day I had not only the trouble of establishing a Government, but I had to keep the natives from attacking the other slave-trading stations. They could not possibly understand the policy of mercy. I explained to them, "Now you are subjects of the Viceroy, therefore you must leave it to me." It would be a long story to tell, but by the use of a little diplomacy and some force I succeeded at last in driving the whole of the slave-hunters out of the country, so that not a single one remained. I confiscated the whole of the ivory in the stations, which was worth about 30,000*l.*, and I sent down to Gondokoro for reinforcements. It was four months before the reinforcements arrived, and that gave me time to establish the Government throughout the country. Now "establishing a Government" is a very curious term. You see, there are all sorts of governments—governments that yield to popular opinion, governments that rule, and governments that are ruled; but I had to form a government with only 140 men to rule in this populous

country, which had lately been the scene of nothing but anarchy. The main thing was to assure the natives that they could depend on the Government and upon its protection. They soon discovered that; and the next thing was to establish an irregular Court and taxation. These natives, like most others, are fond of protection, but do not like to pay for it. The question of taxation is an awkward one, I believe, here in England, though I know nothing about that; but taxation with a negro is a frightful difficulty, because he always has an idea that if you are his friend you must give him something and he give you nothing. When they heard that I was going to tax them, it was a serious difficulty; but at last I arranged it in a very simple form, by explaining to them that, as they had seen with their own eyes what strong men these soldiers were, and how they had driven their enemies out at the point of the bayonet, they must keep up the soldiers' strength by feeding them, and I established a corn-tax. That may appear very ridiculous to a Chancellor of the Exchequer in Europe, but it answered very well there. They have no almanacs there, but I ordered that each house should pay a certain measure of corn at each full moon; that no old man was to pay a tax, because he had not the strength to till the ground; that no woman who had lost her husband should pay, because she had not the strength to do the work; and that nothing should be required from a stranger within their gates, but that only able-bodied men should pay. This, simple as it appears, answered so well that every village paid its tax regularly, and by the time my reinforcements came up from Gondokoro, not only was the Government firmly established throughout an immense territory, but the people were paying their taxes far more regularly, I believe, than they do here, because sometimes here we read of conscience-money—somebody had forgotten to pay. When the reinforcements arrived, there were no appeals made to the Government in the newspapers about violent, atrocious outrages by policemen, or anything of that kind, and the whole country was in the most perfect state of order. No tribe could make war on another without the permission of the Government. The taxes were paid with extreme regularity. In my enthusiasm, when I started from England, I built castles in the air, as we all do; but, at the expiration of the term of this long Expedition, I can only thank God that my castle was built. I left the country, I can assure you, with the greatest possible satisfaction. The whole of that large region was in a peaceful state. I marched down to Gondokoro, through the warlike tribes of Bari, without firing a single shot. I found nothing but peace and goodwill throughout that great territory. All my cares

were therefore over, and I had nothing to do but to thank God most sincerely. I hope it continues in the same state at the present moment.

I left the territory under the charge of a colonel of the army, and I had only one fear. Although, as an Englishman, I had done what most Englishmen could have done, and the result was most satisfactory, I was very much afraid that, as my term had expired, the future Government would be entrusted perhaps to some Turk, who most assuredly would have upset all that I had done. In Cairo I heard from many that the Viceroy was not sincere. Now I had seen that he had had to struggle against public opinion in the suppression of the slave-trade, and as I had suppressed the slave-trade, the people imagined that he had become a Christian, or he would not have opposed a Mohammadan institution and employed me, a Christian, to do it. Now I am afraid that most men under the circumstances would have employed a Turk to succeed me, and that would have ruined my work; but out of respect to England, and I feel really more out of respect for His Royal Highness the Prince of Wales, he has appointed an English officer to succeed me, being determined that, as the English have had the honour of establishing a Government, and giving peace to the country, in the name of the Viceroy, an Englishman should carry on the work that an Englishman began.

In conclusion, I can only say that frequently during my absence, in very anxious moments, I have looked forward to the time when I should return to England. I have always looked forward to meeting the Society in the old hall of Burlington House, and the change I have found has been strange to me. I have often attended meetings of the Royal Geographical Society, but I never saw such a meeting as this. While I know that so much of this welcome is for myself, and feel gratified at seeing this great meeting, I cannot but believe that a great proportion of those present came to welcome the Prince of Wales to the Society. This to me is the greatest honour that can possibly be shown me.

HIS ROYAL HIGHNESS THE PRINCE OF WALES then took the Chair, and said:—

Sir Bartle Frere, Ladies and Gentlemen, Fellows of the Royal Geographical Society:—I do not intend to give you an address, because after the able one which my friend Sir Samuel Baker has just delivered, an address from me would be out of place. I am anxious, however, on this occasion to say a few words of welcome to Sir Samuel Baker, and, on the part of the very large meeting assembled here this evening, to tender him our warmest thanks and acknowledgments for the interesting and clear lecture which he has delivered to us. My friend Sir Samuel has been kind enough to allude to my name on several occasions during the course of his lecture. He has even been kind enough to

say that I have in some way been instrumental in furthering the commencement of that Expedition which he has so clearly shown to you has proved so great a success. He has said almost too much in that respect, for I can assure him whatever conversation I had with the Viceroy of Egypt at the outset of the Expedition, or rather at the commencement of the plans for the Expedition, arose from the great interest which I took in its objects. I felt sure that the Viceroy placed entire confidence in Sir Samuel Baker, and believed that he would be able to carry it through. The difficulties he has had to encounter have, no doubt, been extreme. Those difficulties, however, I feel convinced did not come from Cairo. Sir Samuel has told you what an enlightened ruler the Khedive of Egypt is. Perhaps he is too much in advance of the time in his own country. At any rate, I feel sure that he individually was sincere in his wish to obtain the abolition of the slave-trade in Central Africa, but he had to contend with difficulties thousands of miles from his seat of government, and it was impossible for him to control what occurred. I will say nothing further, but assure Sir Samuel of the pleasure it has given me to see him this evening. During the long years of his absence I always looked forward to meeting him again. We were, no doubt, startled and terrified by the news that he was no longer living, but we trusted the rumour was not true, and felt that so long as there was life there was hope. He has before this attained a high position as a traveller, as a sportsman, and as a Fellow of the Royal Geographical Society, and now I may say he has distinguished himself in a higher character, as a philanthropist performing a work of great benefit to mankind.

Sir BARTLE FRERE: I feel sure that I am giving utterance to the general feeling of all who are here present when I express my belief that this occasion will form an era in their lives. I think it will be a marked day in the history of the British Empire, because you have welcomed back among you one of whom it is not a small thing to say that England will never be ashamed. It is something to have had the veil lifted from that wonderful country which Sir Samuel Baker has described, with its barbarous customs, its unlimited forests, its almost insuperable difficulties of travelling: it is something to have heard from him what he, as an eye-witness, has told you of the great work in which he has been so long engaged—the suppression of the slave-trade; it is something to know that, amidst all difficulties, our English race still retains the character it always had, of being pre-eminently one able to command others, and that the power of empire has not departed, and I trust it is not likely to depart, from the race that Sir Samuel so well represents. I think I may also congratulate this meeting on having heard those details which Sir Samuel has given us of those who were his companions in travel, and of her who now, not for the first time, appears at a meeting of this Society. Under difficulties, from which it is no shame to say the stoutest manly heart among you might well have shrunk, she supported him by her love and true affection. That, I am sure, is a feature in the great work which will not be forgotten. And while we tender our thanks to Lady Baker for her share in what we have heard of this evening, do not let us forget those other noble members of the Expedition of whose support he has so generously spoken. Some among them, who were worthy to follow him—and no greater praise can be given them—have left their bones in those deserts, we may trust not having done an unfruitful work in following him; but there are others who have returned to share with him the thanks which I am sure you will return for the work he has done. I trust a grateful country will not let go unrewarded the merits of those who have followed him. Lastly, and I am sure quite as unanimously as anything that has been agreed to this evening, I trust you will allow me to express your thanks to the Vice-Patron of your Society, His Royal Highness the Prince of Wales, for coming here this evening, as His Royal Highness and His Royal Highness the Duke of Edinburgh have so kindly done. I am sure it must have given them much

pleasure, as affording indications of the manner in which all England will be proud to follow him in taking the lead, and a very effectual lead, in the great work of philanthropy in which Sir Samuel Baker has been engaged. Will you allow me, Sir Samuel, on behalf of this meeting, to return to you and to Lady Baker the unanimous thanks of the Society for your lecture?

SIR S. BAKER: Your Royal Highness, Sir Bartle Frere,—I wish to say one or two words in reply to the kind allusions of His Royal Highness the Prince of Wales to me. I must say that, after passing through so many difficulties, it is good to have one kind word from any one in the position of His Royal Highness; but as he honoured me with his confidence before I started, so in every difficulty and danger I recollect the kind farewell that His Royal Highness gave me. I knew the trust he placed in me, and I was determined that he should not be disappointed. At the same time, when I listened to the kind praise he gave me, I could not help feeling that those praises came more from the kindness of his heart than from my own deserts. I therefore wish now to speak of the merits of others. First of all I must bring to the notice of England and of this Society the merits of Mr. Baker, who is a lieutenant in the Royal Navy. He has been my aide-de-camp throughout the whole Expedition. He accompanied me foot by foot the whole of the way. The whole of the topographical department was entrusted to his charge, and I think the Society will acknowledge that every position he has laid down may be accepted as a true position, so that we can now start as certainly from Fatiko, in Africa, as we could from Greenwich. I believe the Society will be satisfied with all he has done, and I trust—that perhaps I ought not to mention it here, that we shall soon see him in active service, instead of being, as he unfortunately is, on the retired list.

## ADDITIONAL NOTICES.

(Printed by order of Council.)

### *1. Progress of the Livingstone East Coast Relief Expedition.*

#### LETTERS FROM LIEUT. V. L. CAMERON, R.N., COMMANDING THE EXPEDITION.\*

"SIR,

"Mpwapwa, June 16th, 1873.

"Since my last letter from Reheneko Mr. Murphy joined us on the 26th ult., very ill and knocked up, bringing us the sad news of poor young Moffat's death, which occurred on the 22nd May, at a short distance this side of Sembo. He died from the effects of African fever acting upon a weak constitution, the symptoms being great prostration and weakness, and loss of appetite, although when first attacked he ate largely, but after some little time he could take nothing. Murphy did all he could for him, giving him stimulants, but unfortunately did not give enough quinine, or take enough himself, thinking that as the symptoms were different from those of the fever he had at Bagamoyo it was not fever at all, but some other sickness.

"Murphy, on arrival, was so weak that he could not walk without assistance, and we had to wait till the 30th ult. to enable him to be moved with safety,

\* *Vide 'Proceedings,' vol. xvii., No. v., p. 336.*

and then he had to be carried by porters for three days, as he was unable to ride.

"Our first march from Rehenneko was short, on account of the difficulty of getting the men together in the morning, which prevented our starting before 10.30 A.M., after my having five hours' work in driving and bothering to get them together.

"We made two more marches to Muinyi Useghara, where I intended to halt for two days to enable Murphy to recover thoroughly, but were unluckily detained by an unfortunate occurrence at Mbuné, where I had sent a party of men to buy food, as at Muinyi it was both scarce and dear.

"The party consisted of ten askari and thirty pagazi, and all went well at first; however, when all the food was collected and packed, a tom-tom was heard beating, and on our men asking what it meant, the village people said perhaps it was the Watuta coming to rob them. One of our askari then went out of the village gate to see (according to his own account) what was the matter, and, going through, his rifle went off and shot a man and killed him on the spot. Of course there was a great row and confusion immediately, and the man in charge of our people put down his arms and caught the offender, who was trying to run, and took his arms from him, gave them to another askari, and then delivered up to the villagers the man who had fired, saying, "Here is the man who has done the wrong, I must go and see my master and find out what I must do." By this time all the pagazi except one were gone, and dispersed to the four winds, each trying to seek safety in flight; and some of the askari who were separated from the rest also ran. When Umbari (the man in charge, who was one of Speke's Faithfuls, and also up here with Stanley) looked round he found himself alone, unarmed and threatened with violence, so he also got away as best he could. Five askari were made prisoners, and one pagazi. An Arab who had been very civil to us at Reheuneko (Sayd bin Omar by name) and who lives at another Mbuné, about ten miles from the Mbuné at which all this occurred, happening to be in a village near, made the best of his way to the place, and succeeded in preventing our men being ill-used. He also obtained the liberation of one of the askari, and sent him and some of his own men with letters to tell us of the occurrence, and also what we ought to do, saying that the same thing had happened to him some years ago, and he had to pay 80 doti, three slaves, two guns, and a keg of powder, and offering his services to settle the affair, which I gladly accepted, and it ended in our having to pay 109 doti, besides losing three and a half days' food and some 10 or 12 doti in minor presents, &c. The man who had offended was delivered up to us in rather a seedy state, having had his head broken with a knobstick, and the last few days he has been shamming, so I have been able to get nothing out of him, or to punish him as he deserves.

"All this detained us at Muinyi till the 10th inst. We came on here in five marches, the two last from Lake Ugombo being very severe, owing to the absence of water and the long distance to be marched, as we did a good 25 miles in the two days. One pagazi died on the second day, as well as one of our donkeys, which was carrying nothing. We have at present twenty donkeys out of the twenty-four we purchased; one died at Shamba Gonera, one was left lame at Bagamoyo, and one I had to shoot at Muinyi, as he was badly wounded by a leopard or some wild beast, which, with the one mentioned above, completed the number. All the other donkeys are in good condition, and I hope they will continue so and render us good service; one great advantage is that they cost nothing to feed.

"Stanley must have been dreaming when he spoke of Lake Ugombo ever extending to Marenga Mkali; the whole lie of the country forbids such an idea, as we have been gradually rising, and here we are 700 feet above the lake.

"The hills of Useghara are very steep and rocky, making very bad travelling.

"The long delay at Reheneko, and the shooting case at Mbumé, have been very expensive to us in the way of cloth. Of wire we have as yet expended none, and of beads only twenty khete, so we are pretty well off in that way; but to continue any work which Dr. Livingstone may give us, a further supply of cloth is imperative, as well as some few things of which I have sent a list to Dr. Kirk.

"Some more work-books, another set of Inman's tables, and two or three white slates; some quill pens and pencils, also, will be wanted to go on.

"We all three now are in good working order, and, D.V., I trust may continue so.

"News from Unyanyembe seems to say that Mirambo is being beaten back, as all the neighbouring tribes have joined with the Arabs against him.

"Supplies are scarce here, as a band of plunderers is hovering about the mountains under the leadership of a man called Kadrige, and the inhabitants are afraid to meet him in the open, but content themselves with defending their tembes, which are here seen for the first time, so they have had most of their cattle driven off, and corn burnt and destroyed. At Lake Ugombo we saw a party of about sixty men, women, and children, who were migrating with their household goods and goats, as their tembe had been destroyed; they were going to settle at our halting-place of the night before, where a village was being built.

"We have as yet met with no slave caravans, and, from what I hear, the present supply of slaves for the coast is principally drawn from Ubenu and the surrounding districts, the Arabs finding the ivory-trade so much more lucrative.

"I think it is quite certain that the Mukondokwa joins the Wami, and not the Lungerengeri, as the body of water in the Mukondokwa would more than fill the latter's ordinary bed, even now after a month of fine weather, and the Lungerengeri was not nearly full when Murphy crossed it in the middle of the rains.

"As Murphy has sent his accounts at Bagamoyo home it is no use repeating them over again. After my last accounts were sent in I drew 350 dollars to pay Abdullah Dinah his bill, and 100 dollars to clear out the caravan from Kikoka. The balance I had in hand, and the 100 dollars, were spent in hiring pagazis, buying food, and paying the ferry over the Kingani, with the exception of 15 dollars which I sent back to Murphy to help him through at Bagamoyo.

"We have up to the present time expended 25 bales since leaving Kikoka, but much of it is Mhongo and advances to the men; and the halt at Muinyi Useghara cost us, including the money paid for the man killed, nearly 5 bales. Each bale of cloth contains 56 doti. We have still remaining 39 bales common cloth and 4 of coloured, and if we had been able to bring on the stock I had purchased would have been amply provided, but we had to sell to obtain money to pay pagazi, and lost heavily thereby.

"I hope the map I sent arrived safely, and that it will give satisfaction.

"Our letters this time are taken down by an Arab's slave, who starts shortly. He says he did the same for Captains Speke and Grant, so I suppose he is to be trusted.

"V. LOVETT CAMERON, R.N."

"P.S. The last lunar I sent Captain George is not good, as I found afterwards the sextant with a considerable amount of side-error, which I omitted looking at when I took the sights.

"I make the latitude of Muinyi  $6^{\circ} 44'$ , and of this place,  $6^{\circ} 22'$ . Long., &c., I have not yet worked out, but will send it by next letter."

"Sir,

" Since my last, dated Mpwapwa, we have marched on to this place, where we are now detained for a couple of days by 'Mhongo claims. We left Mpwapwa on the 18th, and marched the same day to Kisokweh, which we found occupied by the robber tribe of Wadirigo. They had appropriated all the cattle and crops of the inhabitants, who had emigrated to Madete. They were a fine race of men, and armed with spears, assegais, which they throw well for 40 or 50 yards, and large shields. They wear very little clothing, many, both men and women, going entirely naked. As they seemed inclined to part with their booty cheaply I laid in a stock of goats, as I heard they were dear in Ugogo. On the 19th we marched on to Chunyo, where I got a lunar, which placed us in longitude  $36^{\circ} 1' 59''$ . The water at Chunyo we were agreeably surprised by finding good. Stanley here also drew upon his imagination for the sketch which appears in his book.

" On the 20th we commenced our march across the Marenga Mkali, which was done in two days. The Marenga Mkali is a large plain with a gravelly soil, with here and there small hills and masses of granite piled up, with numerous watercourses all running from north to south. In the rainy season there is no lack of water, as was seen by the numerous khambi we passed all along the road. We bivouacked that night in the open without tents, and marched at daylight on the 21st, reaching the eastern confines of Ugogo after about five hours' march. Here the country, although sterile in appearance, produces abundant crops of matama and 'mwere, besides beans, pumpkins, &c. The water here was dirty, being kept in open pits, into which the dust and dirt drifts with the constant little squalls from the eastward.

" On the 22nd we marched for four hours to a camping-place near the tembe of the chief of the district of Moumé. Here we were detained for three days by 'Mhongo, as at first the chief and all his people were drunk in consequence of one of his sisters having died about a week before. The water here was obtained by digging about three feet in a river-bed near the camp. The country is well cultivated, population and cattle numerous. Got a latitude by Mer. Alt.  $\odot 6^{\circ} 19' 13''$  s.; the height above the sea is 3460 feet.

" On the 26th we marched on close to this place, and camped near to a good-sized pond, on which were numerous waterfowl (teal and divers), and yesterday we came on here, where 'Mhongo has to be paid again, but could do nothing, as the prime minister was drunk. Got latitude by Mer. Alt.  $\odot 6^{\circ} 24' 02''$ ; height above sea, 3362 ft.

" The people here seem a good-humoured, merry set, and arrant cowards. They are very inquisitive, and when we are at meals a crowd collects round the tent doors. They think we are all great magicians, because we light our pipes with burning glasses, and think the sextant and artificial horizon something supernatural.

" The climate here seems good, there is no malaria and apparently nothing to produce fever, and we are all three in the enjoyment of excellent health. We have lost no more donkeys, but since coming into Ugogo have lost seven pagazi by desertion.

" We have left Stanley's route, and intend going by Kanyenze, as Pemberah Pereh, having had some ivory stolen, has avowed his intention of stopping all caravans from Bagamoyo and making them pay. Although we are strong enough to resist any such extortion, still I think it better to avoid any disturbance.

" I am in hopes that we shall settle 'Mhongo to-day, and march to-morrow for Kanyenze, which is two marches off. We ought to reach Unyanyembe, allowing for all stoppages, in thirty days.

" Kimandi, Ugogo: June 28th, 1873.

" Just as I write these words, Issa, the storekeeper, comes in and reports 'Mhongo settled for 23½ doti; some, however, being coloured cloth.

" I must now close my letter, as the leader of the down caravan is off.

" V. LOVETT CAMERON, Lieut. R.N."

" Kanyenye, July 5th, 1873.

" Lat. 6° 23' 38" obs. Long. 34° 58' by acct.

" P.S. Since writing the above we have come on here, and I will give a résumé of our proceedings since then. 1st. The Arab went off again without calling, so we were unable to send our letters from Kimandi, or Muvatta, as it is also called.

" We marched on the 29th, arriving, after four hours, at Mpanga Sanga, an extensive clearing in the jungle, where there were a couple of ponds and several tembe. Here 'Mhongo had to be paid again, and we had to remain a day in consequence. One of the ponds in the rainy season must be of considerable size. We marched on again on July 1st, passing two large ziwa, where there were several waterfowl, ducks, &c., where we halted for breakfast, and then on again till sunset, when we camped in the wild, going on the next morning at daylight to the eastern confines of Kanyenye, the largest district in Ugogo, where we halted near another ziwa, coming on here on the 3rd, where we have been camped since waiting to settle 'Mhongo. Latitude of Mpanga Sanga 6° 22' 25"; height above sea, 3393 ft. Of E. Kanyenye, 6° 23'; and 2861 ft.; and here, 6° 23' 28"; and 2906 ft. We have passed several watercourses, all draining to the southward—some trending rather to the east. Since entering Kanyenye we have passed two pools, the beds of which were thickly covered with salt, of which I am laying in a stock for barter on the road ahead, as I hear it is scarce in front, and therefore will repay carriage. We have been able to do nothing about 'Mhongo yet, as yesterday the king's son was drunk, and to-day he is building a house, but I have sent him a message to say that if he has not time to attend to 'Mhongo I shall suppose he does not want it and shall go away without paying it, so I am in hopes of arranging to-day. Two caravans have come in from Unyanyembe to-day, and bring news that Mirambo is nearly finished off, only having two tembes left to him, and that the Arabs are following up their advantage; if this is true, the direct road to Ujiji will be open, and we may arrive there by the end of September. The soil here is mostly a red sort of loam with a clayey subsoil, which I suppose accounts for the presence of the numerous ponds. The red soil, in places, gives way to black earth, and in others to sand, but, wherever it is cultivated, produces good crops of grain.

" V. L. C."

" SIR,

" Mdaburu, July 14th, 1873.

" We left Kanyenye on the 9th, after having made the longitude by lunars (E. × w. δ × b) 34° 44' 07", which is about 20 miles west of Captain Speke's position. However, as it agrees perfectly with my dead reckoning and lunars at Chunyo and Rehenenko, I am inclined to think it correct. I think, for a considerable distance, the position on both his and Captain Burton's maps are too far to the eastward; Captain Burton's map and itinerary being still further east than Captain Speke's map.

" I am seizing this opportunity of writing just after a heavy day's march from Khoko, as an Arab caravan, who had heard of our coming here, had the great courtesy to wait our arrival, instead of passing us on the march, on the chance of our having letters to send down.

" It belongs to Sayd bin Salim, the principal Arab of Unyanyembe, and is going down to the coast with letters and ivory. I hear Mirambo has only got one village left, but that the direct road from Unyanyembe to Ujiji has been

so plundered during the warfare that it will be impassable for caravans for some time to come.

"I am obliged to close-reef this letter, but I hope to be in Unyanyembe in a little over a fortnight, when I will send more detailed accounts of our proceedings and intentions, as well as map of our route up to there.

"V. LOVETT CAMERON, Lieut. R.N."

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2. *Examination of the Lufigi River Delta, East Africa.* By  
J. KIRK, M.D., Political Resident, Zanzibar.

"THE attention of geographers has, for some time, been called to the Lufigi River, which, throughout its whole course, still remains unknown, the mouths by which it opens to the sea not being even laid down with anything approaching to accuracy in our best maps. It has also been thought that this stream, coming from a great distance inland, might yet prove to be an available water way for trade into Central Africa.

"The head waters of the Lufigi coming from the lands of Urori, Uhena, Uranga, and South Unyamwezi, open to the sea behind the Island of Mafia, a district most imperfectly examined by the Surveying Staff under Captain Owen, who, it appears, did not even see the coast-line or attempt to delineate it on the charts.

"The alluvial Delta of the Lufigi has a sea face of 30 miles in length, but nowhere does it extend far inland; the southern arms are now shut off from the river, or united only by connecting canals with those from the north, by which alone the body of water at present finds its way to the sea.

"Desirous to determine the position of the principal branches, and reach, if possible, the body of the river, where these become united, so as to estimate its comparative importance and the prospects it affords either for further explorations or for trade, Captain Wharton, in company with myself, started in a steam cutter. Entering the Simbaoranga mouth, which we had been told was the largest and deepest, we found on the outer bar not less than one fathom and a-half at low water springs, and inside the river became suddenly much deeper.

"Following a s.s.w. course we ascended this wide mangrove-lined creek, passing many channels going off to the right and left, the first met with on the north being that passing to the sea, known as the Kikuja mouth. About 9 miles up the river, which was still mangrove lined, it divided into two arms of nearly equal size, the one we had ascended being the most northerly; the other, called the Bumba, passing eastward to the sea. On our return we followed the latter, which, although more shallow than the Simbaoranga mouth, seemed to have a right to be considered the main embouchure of the river, the water being here perfectly fresh at the mouth, even when the tide commenced to flow. Three miles above the bifurcation of the Bumba and Simbaoranga streams we came to the Mukurani creek, which, the natives assured us, was the highest offset going to the sea; the Mukurani unites with one of the southern creeks, probably that named the Jazi, which again by cross-creeks is connected with three or four more.

"Above the Mukurani the river makes a great bend, and all mangroves are here left behind, and nothing seen but the alluvial plain covered with the rankest grasses; clearings here and there were observed where rice was being planted, this being the second crop of the season, and here the natives came unarmed to the banks to watch the steamer.

"At the point where we turned to come back to the ship the stream was about 150 yards in width, 6 feet average depth in the channel, and flowing 2 knots. So far as we could see ahead there were neither mountains nor other



MAP OF THE TWO MAIN MOUTHS OF THE RIVER LUPIGI.

From a Sketch by Capt. WHARTON, H.M.S. *Shearwater*.

obstacles to prevent boats from passing; the chief obstruction in this, as in all East African streams, would arise from the sand banks which had begun to appear where we turned back.

"In the dry season I cannot think that a boat of the size of the steam cutter we had would be able to reach very far, although in July, before the water has fallen and the river dried up, there seems no reason to doubt it might pass a very long way up inland.

"The natives we spoke with knew nothing of the river above, but I have been assured that about 200 miles, if not near the coast, it is full of rapids. In comparison with other African streams I have explored it will rank as slightly larger than the Rovuma.

"The slave crossing, where caravans pass from Kilwa to Dardalam and the north, was still some distance beyond where we reached, the muddy delta lands being avoided both on account of the difficulty in crossing creeks, and the scarcity of food, which, higher up, is cheap and abundant.

"I have the honour to forward herewith a plan of the river delta and river so far as examined, which has been kindly placed at my disposal by Captain Wharton, and that may be of interest to the President of the Royal Geographical Society as a small contribution to the map of Africa.

"JOHN KIRK,  
"H.B.M.'s Political Agent and  
Consul-General, Zanzibar."

### 3. On Captain Prshewalsky's Explorations in Mongolia and Northern Tibet, 1870-73. By NEY ELIAS, Gold Medallist R.G.S.

Of the numerous exploring expeditions sent into the interior of Asia of late years, by the Russian Government, one of the most important and best conceived has just been brought to a close by the return of Captain Prshewalsky and his party to St. Petersburg, from Northern Tibet. This officer, who had long been known as an able explorer and naturalist, was deputed by the Russian Geographical Society, under the sanction and supervision of the Ministry of War, in 1870, to lead an expedition, as then announced, to Southern Mongolia; and from that time to the present, many in this country and on the continent have followed his movements with the keenest interest, so far as the meagre accounts from time to time received, would allow of.

He was despatched from St. Petersburg in August of that year, and reached Peking in the early winter, there to make all necessary preparations, and to obtain information regarding the western territories he proposed to traverse. His arrival, however, was ill-timed; for the so-called "Mahomedan rebellion" was just then at its climax, and the whole of North-western China may be said to have been in a state of blockade. During the spring victory after victory had been gained by the rebels in Shensi; its capital, Si-Ngan-fu, had been invested; the valley of the Wei had been cleared of Imperialist troops, and a Moslem invasion of the inner provinces had only been checked at Tung Kuan by the passage of the Yellow River. About midsummer Kuei-hua-Chêng, one of the strongest frontier cities of China, was entirely blockaded from the side of Mongolia, and raids were frequently made into the very suburbs of the town. Uliassutai had been attacked in October, and burned to the ground; and so great were the fears of the Chinese that its fate would be shared by Urga, where the Russians have a considerable interest, that they allowed the place to be garrisoned with Russian troops from Siberia, for the common protection.

Under these circumstances Captain Prshewalsky found it necessary to wait for more peaceful times before commencing his undertaking, but occupied

himself meanwhile with an exploratory journey into Eastern Mongolia. Leaving Peking on the 25th February, 1871, and passing out of China by the Ku-Pei-Kou Pass, he visited the Dolo-nor and the Peitcha range of mountains, and re-entered China by the Kalgan Pass on the 24th April.\*

Affairs in the West having by this date become more encouraging, he re-formed his party, and, after only a few days' halt at Kalgan, commenced, on the 3rd May, to put his main project into execution. The expedition now consisted of three Europeans besides the leader—viz., Mr. Pyltsoff and two Cossacks, and, with a caravan of eight camels and some ponies, the course was directed along the southern edge of the Mongolian table-land towards the town of *Bautu*,† on the Yellow River. Here the river was crossed, and followed up for some distance through the Ordos country, when summer having set in, a halt of nearly three months was made for the purpose of resting the camels. In September they again proceeded towards the south-west, re-crossing the Yellow River at *Dyn-chu* (*i.e.* Tchagan-Subar-Kahn) into the Ala-shan country, and following up the left bank of the stream to *Dyn-Ioan-In*,‡ the chief town of the district, and now almost entirely destroyed by the Tunganis. From this point Captain Prshewalsky made some short excursions into the neighbouring ranges, and added many specimens of birds and quadrupeds to his collection; but becoming convinced that he had not sufficient funds to continue his journey successfully, and his companion, Mr. Pyltsoff, being in an uncertain state of health, he, with great reluctance, decided to return to Peking; and on the 15th October commenced to retrace his steps, reaching Kalgan, his original starting-point, on the 31st December.§

During the next two months he employed himself in making preparations for a renewed attempt, his late experience having taught him what was most needful to ensure success. Five more Cossacks were obtained from the Government, and the whole seven were armed with breech-loaders and revolvers, and thoroughly drilled in the use of them; a quantity of obsolete muskets and pistols were bought at Tientsin for purposes of barter with the native tribes of the West, who are but ill-acquainted with the value of silver; and a certain amount of time was devoted to learning from Dr. Fritsche, the Superintendent of the Russian Observatory at Peking, the more simple operations in nautical astronomy. No competent Chinese interpreter, however, was attached to the expedition, which is a circumstance greatly to be deplored, for undoubtedly it was to the inability of any of the party to communicate with the Chinese, in the towns and settlements passed through, that is to be attributed most of the ill-will and annoyance experienced on both this and the former journey. A large and well-armed party of strangers, though perfectly independent among the lawless tribes of the desert, is just as much at the mercy of the inhabitants of the towns for supplies of food and animals as a single unarmed traveller; and, moreover, the show of power causes them to be shunned by guides and others who might be of assistance. These, combined with a general inexperience of Chinese human nature, are some of the disadvantages from which Captain Prshewalsky's expedition is known actually to have suffered; and which, by the presence of a trustworthy interpreter in the party, would certainly have been modified, if not entirely obviated.

\* For a short account of this exploration, see Petermann's 'Mittheilungen,' No. iii., 1873.

† This place is not marked on any map that I am aware of; it can, however, be at no great distance from Pilotai, and is probably at, or near, the mouth of the *Foto* tributary of the Yellow River, as marked on D'Anville's map. It is generally spoken of as 320 *li* by the road from Kuei-hua-Ching, and called *Si-Pau-To*.

‡ *i.e.* Wei-tching-pu, in about lat.  $38^{\circ} 55'$ , and long.  $105^{\circ} 45'$ .

§ An interesting notice of this second exploration also appeared in the 'Mittheilungen,' *as above*.

The final start was made from Kalgan on the 3rd March, 1872, and somewhat the same route as before was followed as far as *Dyn-Loan-In* (Wei-tching-pu), in Ala-shan, which was reached on the 26th May. Here the party joined a Chinese caravan, and in company with it travelled a month's journey through Kansu to the lamasary of *Tschebsen*, situated at 60 versts (34·5 geo. miles) north-east of Sining-fu, which latter city was still in the hands of the Tunganis, though a considerable Chinese force, sent to retake it, had for some time past been in occupation of towns in the immediate neighbourhood. During July, August, and the greater part of September, Captain Prshewalsky remained at Tschebsen, shooting specimens for his zoological collection, and studying the flora of the neighbourhood,—occasionally, during his excursions, falling in with bands of roving Tunganis, who, though a terror to the native Mongols and Chinese settlers, had heard of the efficacy of his arms, and never ventured to molest him.\*

From this point we are enabled to follow Captain Prshewalsky's exploits from his own account, as given in extracts from two letters dated from *Dyn-Loan-In*, while on his final return journey towards Siberia, and lately read before the Geographical Society of St. Petersburg :—†

#### LETTER I.

From Staff-Captain PRSHEWALSKY to the RUSSIAN MINISTER at PEKING.  
Dated from DYN-LOAN-IN, in ALASHAN, the 17th (29th n. s.) June, 1873.

" . . . We finally left Tschebsen on the 23rd September, 1872, turning our faces towards the Koko-nor across the territory occupied by the Tunganis, and following a mountain path leading between the towns of *Da-toun*‡ and *Sin-huan*. During this passage we ran great risks, but were incredibly fortunate. We passed the most dangerous positions without meeting with anyone, and it was only on the day after our departure that we discovered, in a defile, a party of about 100 Tunganis.

" At the first sight of our caravan they fired a few shots at us, and then, as far as we were able to judge from the distance of two *versts* by which we were separated, prepared to attack us. The Mongols, who were acting as our guides, became terrified, and begged us to return at once to Tschebsen, but I well knew that a retreat on our part would only embolden the Tunganis, and, moreover, they being on horseback, would easily have overtaken our caravan; I resolved, therefore, to advance at once. Forming an advanced guard of four men, with their rifles in their hands and revolvers at their belts, we moved on, followed by the camels which were being led by the Mongol guides. These latter were strongly tempted to take to their heels, and it was only on my declaring that in that case I would shoot them before firing on the Tunganis that they decided, with the best grace they could muster, to follow us. The situation was critical, and this was the only means of extricating ourselves; we had on our side superior weapons and the known cowardice of the Tunganis. It turned out as I had anticipated; seeing that we advanced without flinching at their fire, and knowing, no doubt, that we were well armed, they would not allow us to come within a  *verst* of them, but turned

\* See letter from Prshewalsky, read before the Russian Geographical Society on 18th April last, and published in Petermann's 'Mittheilungen,' No. vii., 1873.

† See 'Journal de St. Pétersbourg,' 6th December, 1873.

‡ This is the *Tatung* of maps, and the *Ho-Kiao-Y* of Huc, who says (vol. i. p. 286, Eng. ed.), *Tai-Toung* was the ancient name, but is now no longer in use. D'Anville, strange to say, does not notice this place at all, either on the map or in the tables.

and ran like a flock of sheep before a wolf. Thus, though we had not fired a shot, the Rubicon was passed, and the rest of the route to Koko-nor was free.

"Following the Kan-su mountains almost as far as the source of the River *Da-toun-he*\* we arrived in the valley of the Koko-nor, and pitched our tent on its shores on the 14th October.

"In all my life I have never beheld such a beautiful lake as this Koko-nor. Its salt waters are of a magnificent deep blue, and in the month of October the snow-clad mountains surrounding it formed a frame of sparkling white to the picture. The neighbouring steppes are extremely fertile, and are inhabited by large numbers of the *Antilope gutturosa*. Mongols and Tangouts are very numerous, and in every direction enormous flocks and herds are to be seen at pasture on the grassy plains. The absolute height of Koko-nor is about 10,000 feet.

"Although the lake was not yet frozen over, but few birds were seen upon it; and, after passing a few days on its shores, we recommenced our journey. I well knew that we should not be able to reach Lassa, for, after purchasing a few camels at Koko-nor, there remained only 320 roubles, but, nevertheless, feeling certain of obtaining a constant supply of food by means of our guns, I resolved to continue to advance as long as possible.

"After crossing the high mountains, which rise from the south shore of the lake and extend 600 versts [345·4 geo. miles] further towards the west, we entered the Tsaidam country; this district is one vast marsh,—its perfectly plane surface, covered with salt and reeds, showing that, at some not far distant period, it has formed the bed of an immense lake. Sheltered on the north by the mountains rising from the southern shore of the Koko, and on the south by the chain of the *Bourkhan-Bouda*, these marshy valleys of Tsaidam stretch far away to the westward; indeed, according to the Mongols, they extend uninterruptedly as far as Lake Lob. In this region, and at a distance only of some 300 versts [172·7 geo. miles] to the westward of our route, wild camels roam at large and are hunted by the Tsaidam Mongols. For want of money I unfortunately found it impossible to go further in that direction, for it was now necessary to save every rouble, and, in order to go hunting wild camels, I should have been forced to hire a guide at the rate of 20 *lances* † a month; and, besides, it would have been necessary to buy three or four fresh camels to carry a supply of water, or ice; for, in the region where the wild camel occurs, the soil consists only of clay and salt, and no water is to be found. Thus the failure of my pecuniary resources prevented me from finally settling at rest the interesting question of camels in a wild state; though their existence to the west of Tsaidam I look upon as incontestable. I begged the *vane*‡ of Koko-nor to procure me the skin of one of these animals, but on my return to his country from Tibet he had not yet done so. §

\* The *Tatung-ho*, or *Tutung-ho*.

† Chinese, *liang*, viz. the *tael* of commerce, equal at Peking to about 6s. 6d. sterling.

‡ Chinese, *Wang*, or prince.

§ Hitherto, to have faith in the existence of wild camels, has, I believe, been considered zoological heterodoxy: but recent evidence on the subject would seem to prove, not only their existence, but also that the area over which they are distributed is a very extensive one. Besides the Tsaidam valley, where Captain Prshewalsky heard of them, Colonel Yule informs me that Mr. Douglas Forsyth, in a late letter from Shahidulla, mentions "that the official who had come from Yarkand to meet the party said he had shot them in the desert near Turfan." Again, to the north of the Tian-Shan, the evidence I received on this subject in 1872 from intelligent Chinese travellers, as well as from the native Mongols, is

"In the midst of the marshy valleys of Tsaidam there flows the *Baian-gol*, a river of 400 versts [230·3 geo. miles] in length, and of great breadth. At the point where we crossed, it measured 230 *sazhens* [1610 English feet], and, though the depth is but two or three feet, the soil being muddy, the passage is only effected with great difficulty. At the time of our crossing, however, it was fortunately frozen over. The altitude of the valleys of Tsaidam is some 1000 feet below that of the Koko-nor, and their climate is very much warmer. The *vane* [prince] of Koko-nor (or rather his uncle, for the prince himself had been dead since the previous year) received us most cordially; he even made us a present of a small *yourt*, or tent, to replace our own, and in return I offered him a revolver and a woollen cloak.

"There are but few wild beasts in Tsaidam, probably on account of the salty nature of the soil, for in some places many square miles are covered with a layer of salt like ice, which wears away the hoofs of animals; but, on the other hand, I found here a new variety of pheasant. In the Koko-nor district I saw dozens of new species of birds, and, amongst others, a new *Syrrhaptes*, differing essentially from that of the Gobi. Until now but one species of this bird has been known—the one which Pallas named *paradoxa*. . . .

"On the 20th November we found ourselves at the foot of the mountains called *Bourkhan-Bouda*, which forms the edge of the cold and desert heights of northern Tibet. To the south of this chain, and as far as the Tanla Mountains, the country rises to the enormous elevation of 14,000 to 15,000 feet above the sea. Besides these the *Chouga* and *Gourban-Naidji* ranges also raise their lofty summits above this tremendous table-land. Both of these attain the limit of perpetual snow, and the Gourban-Naidji chain is that which forms the starting-point of the system of the Kuenlun, which shelters towards the south the western part of Tsaidam and the valleys of Lob-nor. We passed 50 versts [28·8 geo. miles] to the eastward of the Gourban-Naidji, and, after crossing the low range of *Baian-Khara-Oula*, we at last arrived on the banks of the *Yan-Tsy-Tsian* [Yangtsekiang], or *Mourouï-Ousson*, as it is called by the Mongols. Thus we were now on the other side of the Kuenlun, which is at a distance of about 100 versts [57·6 geo. miles] from the Mourouï-Ousson.

"The Blue River [Yangtse] marks the limit of our journey into Central Asia. In spite of all the regret it caused us, it was absolutely necessary to abandon the project of pushing on to Lassa, though we were separated from it only by 27 marches. Cold, storms, want of food—the terrible difficulties against which one has to struggle in these Tibetan deserts—had so exhausted our beasts of burden that out of eleven camels three had died, and the remainder were scarcely in a condition to travel. Not only was the money wherewith to buy fresh ones wanting, but, even had we possessed it,

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undoubted. Many of the former, who declared they had seen these animals between Kobdo and Ili, Uliassutai and Kuchén, &c., I questioned as to their being really wild, or having become so subsequent to domestication; but the answers were always, emphatically, that they had never been tame; and in several cases my informants mentioned that, in this respect, they differed from the wild cattle, thus showing a distinct appreciation of the difference of condition. Moreover, the wild camels were always described to me as smaller in size and much darker in colour than tame ones, and on some occasions I was told they had but one hump. The latter feature, however, would imply a specific difference, and as my authorities were at variance on this point, it is perhaps a doubtful one, though instances, I believe, are not wanting of domesticated animals having come to differ specifically from their wild ancestors, and *vice-versa*. In the matter of size, Colonel Yule remarks that Mr. Forsyth's "account agrees exactly with what you heard as to their being much smaller than the tame camel."

it would now have been useless, for all that portion of northern Tibet lying between the *Bourkhan Bouda* and *Tinla* ranges—a distance from north to south of 800 versts [160·7 geo. miles]—is an uninhabited country. It was then with the deepest sorrow that, on the 13th January, I left the banks of the Blue River and commenced to retrace my steps.

"Our journey of three months (23rd November to 10th February) in the solitudes of northern Tibet was the best period for shooting that I experienced during the whole expedition. Intense cold and continued gales, it is true, often prevented our hunting, though, when we were able to do so, the abundance of game was such that we could kill any quantity we pleased. Wherever the smallest quantity of grass grew we met with large herds of yaks (*Pephasus grunnicus*), gazelles, antelopes, 'orongo,' 'ado,' of a new species; mountain sheep who sometimes go in flocks of several hundreds; a new species of mouflon (*Ovis argali*) with breast as white as snow, and wolves who followed our caravan to feed on the dead animals we threw away. These wolves, never having been molested by man, allow themselves to be approached without the slightest fear; and at the report of a rifle, and even the whistling of the ball, they only looked up in astonishment.

"I cannot express to you what a charm these herds of wild beasts had for me! From morning till night I carried my gun and scoured all the mountains and valleys in the neighbourhood. The beasts that interested me most were the yaks; I shot 20 of these without counting the wounded, which must have amounted to treble the number. This animal is certainly most remarkable. The adult male attains to enormous dimensions. The one whose skin now figures in my collection measured 11 feet in length, without the tail, which of itself was 3 feet; thus the total length was 2 *sazhens* [just 14 feet English], the height of the hump was 6 feet, the circumference of the body in the middle 11 feet, and the weight of the animal from 35 to 40 *pounds* [11½ to 12½ cwt.]. In northern Tibet millions of these great quadrupeds roam at large; their principal characteristics are indolence and stupidity, which renders them less formidable than at first sight they would appear to be. If the yak were possessed of more intelligence he would be far more dangerous to the sportsman than the tiger, for one can never be sure of killing him with whatever weight of ball. It is almost impossible to hit him in the brain, for that organ is extremely small (it weighs only a pound in an animal of 1600 lbs.), and he carries his head in such a way as to prevent the bullet from reaching just that portion of the forehead behind which the brain is situated. If he is shot in the eye, or in any part of the skull, the bone stops the ball, as I have myself proved by firing at a yak at 50 paces.

"... We killed in Tibet various animals—86 in number—which furnished us with meat to the extent of 1000 *pounds* [16 tons, 14 cwt.] As it was useless to load ourselves with unnecessary burdens we usually retained only sufficient for one day's consumption and threw the rest away; and this meat, together with barley-flour, and brick tea, formed our only food during the whole period of our wanderings in Tibet. Our clothes were in such ragged condition that we looked like beggars; for some time past we had had no soles to our boots, and had had to repair them by sewing on pieces of the skin of the yaks we killed, and thus miserably shod we had to endure a temperature of 25° (Réaumur) of frost. Even now that we have arrived at *Dyn-Jean-In* we are in such a dirty and tattered condition that, as soon as the Mongols see us, they exclaim, 'They are just like our fellows; they are regular Mongols!'

"On account of the altitude of northern Tibet it is extremely difficult to breathe, and especially if one walks quickly, sickness, trembling of the legs, headaches, and vertigo, are often experienced. Also the bird-droppings we used for fuel burned but feebly, on account of the extreme rarefaction of the

air. M. Huc, the missionary, explains these phenomena on the Bourkhan-bouda Mountains by the presence of a suffocating carbonic acid gas; but this is entirely incorrect, for in summer a great number of Tsaidam Mongols live on the Bourkhan-bouda, which would be impossible if this gas really existed.

" And now a few remarks *à propos* of Huc :—

" 1st. In the Koko-nor country he describes a difficult passage across twelve arms of the River Boukhain-gol,\* whilst the fact is that this stream has in all but one channel, at the point where the Tibetan road crosses it, and this channel is only 15 sazhens [105 English feet] broad, and but one to two feet deep.

" 2ndly. Immediately after passing the Boukhain-gol the high chain of the southern Koko-nor Mountains is reached, which Huc does not even mention.

" 3rdly. He depicts the Tsaidam country as an arid steppe, whereas it is in reality a salt-marsh covered everywhere with reeds of 5 to 7 feet high.†

" 4thly. He makes no mention of the Baian-gol, or Tsaidam River,‡ which is 22 times broader than the Boukhain-gol, and the passage of which, when unfrozen (as it must have been when he passed it), is extremely difficult.

" 5thly. What he says regarding the gas on the Bourkhan-Bouda § is doubtful.

" 6thly. He represents the ascent of the Chouga Mountains as very steep;|| but both the ascent and descent of this chain are so gentle that a railway might be laid across it.

" 7thly. The chain of the Baian-Khara-Oula, about which Huc relates marvellous stories, is nothing but a succession of low elevations, never exceeding 1000 feet in altitude above the northern valleys, and only slightly steep on the side of the Blue River [Yangtse]. There is here no passage, and the road follows the River Namchitai-Oulan-mouren, which discharges into the Mouroui-oussou [Yangtse].

" 8thly. Huc speaks only of having crossed the Blue River; but the Tibetan road lies along its bank the whole way up to its source in the Tanla mountains, a distance of 300 versts [172·7 geo. miles]. In Koko-nor and Tsaidam the great caravan, which Huc professes to have accompanied to Lassa, is perfectly well remembered, and it is somewhat astonishing that

\* The Pouhain-gol of Huc.

† With the exception of his omission to mention the reeds, Huc's account does not differ greatly. He says (vol. ii. p. 113, Hazlitt's Eng. ed.), "The soil, arid and stony, produces with difficulty a few dry, salpetrous bushes. . . . Mineral salt and borax abound on this arid and almost wholly pastureless soil."

‡ He distinctly mentions it, under the latter name, thus: "On the 15th November we quitted the magnificent plains of the Kou-kou-Noor, and entered upon the territory of the Mongols of Tsaidam. Immediately after crossing the river of that name, we found the aspect of the country totally changed" (see p. 113, as above). This district of Tsaidam must have been traversed by the German Jesuit missionaries John Grüber and Albert Dorville in 1661, on their way from Peking to Benares, and was probably the country known to them as *Toktokay*. The former, or rather his editor, says of it (see Pinkerton, vol. viii. p. 591), "Leaving this sea behind him, he entered into the country of Toktokay, which is almost desert, and so barren, that it need fear no invasion. One meets with nothing but some tents of Tartars. It is watered by the Toktokay, a very fine river, whence it takes the name. It is as large as the Danube, but so shallow that it may be forded everywhere."

§ He calls this range Bourhan Bota, and explains "that it means Kitchen of Bourhan; Bourhan being a synonym of Buddha" (p. 115).

|| Here Capt. Prshewalsky must have misread his author, for Huc's words are (see pp. 115, 116), "Mount Chouga being not very steep in the direction where we approached it, we were enabled to attain the summit by sunrise."

nobody has any recollection of the presence of foreigners among its members. Huc further asserts that he passed eight months at Gumbum [Kounboun]; but I saw many lamas who had resided in that temple for 30 and 40 years, and all solemnly assured me that there had never been a foreigner amongst them. On the other hand, in the Alashan country, the presence of two Frenchmen at *Nin-jia* [Ning-hia-fu] 25 years ago was distinctly remembered.

"On the 10th February we again descended into the Tsaidam valley and struck out for the Koko-nor. The whole of the month of March we passed at the mouth of the River Boukhain-gol. Contrary to our expectations the flights of birds of passage\* were very unimportant, and, in all probability, took place to the east of Koko-nor, or in China proper, along [sic] the Central Asian plateau. That route is much the best for birds, for they thereby avoid the deserts of Tibet, the lofty mountains of Kan-su and the sands of Alashan. The months of April and May I employed in studying the flora and fauna of the Kan-su Mountains, and on the 15th June I arrived at Dyn-Ioan-In, where I shall stop for a month, and then proceed to Urga through Central Mongolia.

"My collections are very large, for I am bringing back over 1000 birds, 40 large animals, and hundreds of small ones, besides four large cases of plants, which constitute the loads of two camels. I have determined, astronomically, the latitude of Koko-nor at the mouth of the Boukhain-gol, of the foot of the northern slope of the Bourkhan-Bouda Mountains, and of the Mouroui-oussou; besides this we, every day, fixed the absolute altitude by hypsometrical observations; and, finally, I have constructed a chart of the whole of my journey, so that when the old one, which I left at Peking, is joined on to it, my map will comprise the whole of the region of Central Asia lying between the *Dalai-noor* [Dolo-nor] and the sources of the Yangtse. I shall also make a survey of the route from Dyn-Ioan-In to Urga. Such, then, are briefly the results of the second period of my journey, but they would certainly have been more extensive had my pecuniary resources not failed me. If I had had sufficient money I should have gone to Lassa, if not even further. The road from Tsaidam to Lob-nor was open; it would have been possible to procure a guide, and the distance was but that of a month's march."†

\* In a previous letter (see 'Mittheilungen, No. vii., 1873) he mentions that he would make it his object to observe the flight of birds of passage on Lake Koko.

† It is much to be regretted that no more precise notice of the distance of Lake Lob is here indicated by our traveller, for it will be remembered its position has given rise to some discussion. Père Gaubil, writing from Peking on the 6th October, 1726, gives the position of the centre (see Souciet, 'Obs. Mathém. en Chine,' &c., Paris, 1729, vol. i. p. 179), deduced from a Chinese itinerary based upon Hami, as lat.  $42^{\circ} 20'$ , and long.  $25^{\circ}$  w. of Peking ( $91^{\circ} 28'$  e. of Gr.); whilst the lat. of Hami he states to have been observed by MM. Jartoux, Fridelli, and Bonjour, with a large instrument, at  $42^{\circ} 53' 20''$ , and the longitude to have been fixed from their data at  $95^{\circ} 56'$  e. Since that time, however, the longitude of Hami has been more nearly computed at  $94^{\circ} 40'$  e.; so that  $1^{\circ} 16'$  must be deducted from Gaubil's meridian of Lake Lob, leaving it at  $90^{\circ} 12'$ .

Assuming from Captain Prshewalsky's description of his route that he crossed the Tsaidam River in about lat.  $36^{\circ} 10'$ , and long.  $97^{\circ} 30'$  e., the direct distance thence to the centre of Lake Lob would be 504 geo. miles, or allowing one-sixth for probable windings of the road, 588 geo. miles, which would be more than a month's journey for camels, for it would suppose them to accomplish  $19\frac{1}{2}$  geo. miles a day without any allowances for halts. And this is assuming the most favourable case; but taking the position of Lake Lob, assigned by Mr. Shaw, from original native itineraries obtained by him in Eastern Turkistan (see Royal Geographical Society's 'Proceedings,' vol. xvi. No. iii.), as about lat.  $40^{\circ} 30'$ , and long.  $84^{\circ}$ , the distance from the same point of the Tsaidam valley becomes, in a

## LETTER II.

Addressed to M. KOYANDER, SECRETARY of the RUSSIAN LEGATION at PEKING,  
and dated DYN-JOAN-IN, 17th June, 1873.

"In my letter to the minister I gave a brief outline of the results of my travels during the present year, and now I will attempt to complete that outline in writing to you. I will begin with the human race. In the countries I visited, that is to say Kansu, Koko-nor, and Tsaidam (for northern Tibet is uninhabited), there exist three, or rather four, races: viz., Chinese, Tangouts, Mongols, and Daldes. The first are only met with in Kansu, and differ neither in characteristics nor customs from their fellow countrymen at Peking. Together with the Chinese, are found in Kansu, and there only in the neighbourhood of Sining, a distinct race called *Daldes*, having no affinity to either Mongols, Tangouts, or Chinese. Their type approaches more nearly to that of the Mongols than to the Chinese, whilst their dialect is, according to the statement of the inhabitants, a mixture of Mongol and Chinese. The *Daldes* occupy themselves with agriculture, and inhabit houses (*fanz*)<sup>\*</sup> similar to those of the Chinese.<sup>†</sup> Only having seen these people as a passer-by, I have not been able to study them closely.

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straight line, 690 geo. miles; or, still adding only one-sixth for windings, 805 geo-miles, a distance entirely impossible for camels to make good in a month. Thus, primarily, the discrepancy is brought to lie between Mr. Shaw's estimated position of the lake and Captain Prshewalsky's statement of its distance, in time, from the Tsaidam valley; but if we confront the latter's short assertion with Mr. Shaw's elaborate and well-considered itineraries, converging on Lake Lob from several sides, it must be conceded that Captain Prshewalsky has done nothing, thus far, to enlighten us on this interesting subject, and the question still remains to be decided between Gaubil and Shaw.

It must be remarked, however, that most modern maps, including Keith Johnston's, Ritter's, Kiepert's, &c., place Lake Lob  $1^{\circ}$  to  $1^{\circ} 50'$  w. of Père Gaubil's meridian; but I have taken the latter's position for comparison, as being most favourable to Captain Prshewalsky's view, and also because it is nowhere stated upon what authority any change was made by those geographers. It is in all probability, however, due to the survey of Eastern Turkestan by the Portuguese missionaries, d'Arocha, Hallerstein, and Espinha, between the years 1756 and 1760 (about), the results of which were published, in a map of 104 sheets, at Peking some thirty years after the publication of d'Anville's Atlas, where Gaubil's data are utilised. In the tables of positions supposed to result from this survey, Lake Lob is not given, and it was probably placed on the map by interpolation. (See this table: Amyot's, &c. 'Mémoires concernant les Chinois,' vol. i. p. 399, Paris, 1776; Demailla's 'Hist. Gén. de la Chine,' vol. xi. p. 575, Paris, 1777; &c.)

The position of Lake Lob, estimated by the itineraries of the Buddhist pilgrims, starting from known points in the east, is very indefinite, the cause being chiefly that their distances are always given in *li*; and though we know that the *li* of their day (400 to 629 A.D.) was much shorter than the one now in use, yet the amount of difference remains uncertain. (See Julien's 'Contrées Occidentales,' Paris, 1857; Beal's 'Fa-Hian and Sung-Yun,' London, 1869; &c.)

\* Chinese, *fang-tse*, house.

† The description of these people, as also the locality in which they occur corresponds closely with Huc's account of the race he calls *Dchiahours*. The name of *Dalde* may certainly have suffered in copying or printing, but I can find no approximation to it in any work treating of Western China; nor, with the exception of Huc's, it must be added, of the *Dchiahours* either. The only specimen of *Dchiahours* that I am personally acquainted with is Huc's old servant 'Samdachiemba,' who certainly, as regards language, corresponds to Prshewalsky's description of the *Daldes*.

"The Mongols, of whom there are but few in Kansu, though in large numbers in Koko-nor and Tsaidam, belong to the family of *Eleuthes*, and, judging by their type and characteristics, I should say they are the most ill-favoured offshoot of their race. Physically they resemble the Tangouts, with whom they intermix more and more. The pure Mongolian type has here become much modified and disfigured; the expression of the face is one of stupidity; the eyes are dull and lifeless, like sheep's eyes; and the disposition gloomy and melancholy. They have neither energy nor ambition, and, for all but eating and drinking, they show a brutal indifference."

"The *vane* [prince] of Kokonor himself, in speaking to me of his subjects, likened them to animals: 'put them on all fours,' he remarked, 'and there you have them—regular cows!'

"The *Tangouts* who inhabit Kansu, Koko-nor, and part of Tsaidam in great numbers, remind one, by their type, of our *Tsigunes*,\* and to whom they show even a greater resemblance in character. Gross as the Mongol may appear to a European, still he becomes a civilised man when compared with the *Tangout*. His dwelling—the *yourt*—is a palace by the side of the *Tangout's* tent, in which latter one frequently finds the mud knee-deep, and a few armfuls of bushes strewed on the ground to serve as a bed. One may say, without exaggeration, that the burrow of the marmot, or the '*lagomys*', is ten times more comfortable than the dwelling of a *Tangout*. The animal at least has a soft, warm, litter, whilst the *Tangout's* tent, made, as it is, of a fabric as open as a sieve, neither protects him from the rain nor the cold.

The chief trait in the character of the *Tangouts* is their love of thieving and cheating. In this respect they even surpass the Chinese, and, indeed, stand in the same relationship towards them as these latter do towards the Mongols. One tribe of this race, the *Khara-Tangouts* [Black Tangouts], who inhabit chiefly the Koko-nor district, live entirely by brigandage, and keep the whole country in a continual state of alarm. The Mongols are the victims of their attacks, and these they not only plunder of their cattle but also murder them or carry them off into slavery.†

The Koko-nor Mongols being naturally of a cowardly disposition have never been able to defend themselves against *Tangout* aggression, for, according to the laws of the *Tangouts*, if one of their people is killed by a Mongol his family receives from the murderer the enormous fine of 1000 *lances* [about 320*l.*], and if he should chance to be a poor man the whole of his tribe has to pay for him. In case of payment being refused, the *Tangouts* assemble by hundreds and make open war on the Mongols, whilst the local authorities, who have been liberally bribed beforehand, affect to know nothing of the matter.

\* Gipsies.

† These *Tangouts* would appear to be *Sifans*. The country they inhabit is precisely that of the Sifans (see Duhalde, vol. i. p. 41; Ritter, 'Erdkunde von Asien,' Th. ii. p. 176; &c.), and thus is part of what the earlier writers understood by "Tangut." Duhalde (p. 41) tells us the Sifans are divided into *Yellow* and *Black* tribes (*Hoang-Sifan* and *He-Sifan*), though, he also says, they sometimes build a few miserable houses; and Ritter (p. 177) shows them to be the original natives of the soil in the district in question, and the Mongols to be immigrants of a later date. Huc, in speaking of the Sifans, mentions several circumstances tending to identify them with Prshewalsky's *Tangouts*. He says (vol. ii. p. 80) their tents "are very cold, and a strong wind knocks them down without the least difficulty;" and at p. 82, "they weave a sort of coarse linen, of which they make tents and clothing." He also remarks how their energy, vivacity, and warlike spirit contrast with the character of the Mongols, and says several of their tribes "constantly exercise their brigandage up to the very frontiers of the empire."

"Towards us the Tangouts behaved respectfully enough, being perfectly aware that we should not hesitate to fire on them on the least provocation, and also that we should pay no fines. They also ceased to plunder in the localities where we happened to be, so that the Mongols were delighted at our presence. While on the way to Tibet we left a bag of flour in Tsaidam, having just then no need of it, and the Mongols, in taking charge of it, assured us that it would be the saving of the whole of Tsaidam. And this in reality happened; for the Mongols, having everywhere spread the report that we had confided valuable property to their keeping, not a single brigand dared to show himself, for fear of being implicated in the robbery of Russian property. Nor was this all: on many occasions chiefs of Mongol tribes sought me out, to beg of me to order the Khara-Tangouts to restore cattle they had stolen from their people. Occasionally, also, whole troops of Mongols would come and ask for my benediction, or, sometimes, for permission to pray for me, as a general idea prevailed that I was some great saint."

Of former travellers Huc's route more nearly coincides with Captain Prshewalsky's than any other that I am aware of, and, in spite of the latter's rather severe criticism of that author, the foregoing account must, after making certain allowances for differences of ear, circumstances of travel, &c., be looked upon as confirmatory, rather than otherwise, of his story. Grüber and Dorville's route would seem to have been struck at some point to the westward of Sining, and on, or near, the northern shore of the Kokonor, if we assume those travellers to have rounded the northern shore of the lake as Prshewalsky and Huc appear to have done; though, supposing them to have kept to the east and south of the lake, the junction would probably only occur at some point in Tsaidam. The routes of Hiouen-tsang (628 to 645 A.D.) and Sung Yung (500 to 518 A.D.), are too far to the north for Captain Prshewalsky to throw light upon; Fa-Hian's outward route (A.D. 400) he certainly crossed at some point in southern Kansu, and Marco Polo's he must also have touched upon, or nearly so, though further to the north-east, in the Alashan country, and probably not far from that traveller's *Culachan* ('Yule,' ii. 248), or *Calacian*\* ('Fauthier,' p. 206), the "capital city" of Egrigaea.

Captain Prshewalsky's detailed narrative will be looked forward to with great interest, and will, probably, not only explain such matters as "Dalde" and "Tangout," and afford much novel information to naturalists, but will also throw some light on the blankest space of the whole map of Asia, viz., the country between the Tsaidam and Khoten, bounded on the one hand by the frozen heights of northern Tibet, and on the other by the burning sands of the southern Gobi, a country, we are told, that was once the site of towns and caravan roads, but of which, at the present day, we know absolutely nothing.

In the mean time it is interesting to consider the few altitudes, given above in round numbers, in connection with the view of the Kuen-lun escarpment of Tibet ably put forth by Mr. Shaw in Vol. xvi., No. V., of the Royal Geographical Society's 'Proceedings,' and commented upon by Sir Henry Rawlinson, General Strachey, and other eminent geographers.

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\* It is impossible not to remark the similarity, in sound at least, between this name and *Alashan*.

4. *Hann's Expedition in Northern Queensland.* By Mr. W. HANN,  
Leader of the Expedition Party.

[Communicated by the Colonial Office.]

On the 26th June, all being in readiness, our final start was made from Fossilbrook, the party consisting of Mr. William Hann, leader; Mr. Taylor, geologist; Dr. Tate, botanist, &c.; Mr. Warner, surveyor; Mr. Stewart and Mr. Nation, members of the party; Jerry, blackboy; with twenty-five pack and saddle horses, twenty sheep, and five months' supply of flour, tea, sugar, and other necessaries.

The first object to which I intended devoting my attention was an examination of the country around the Kirchner Range, it having been noticed by Leichhardt on his journey down that stream upon his first great expedition, as likely to be auriferous. The party started following the course of Fossilbrook Creek, which takes a general course of north, when on the third day, the Lynd was reached in twenty-five miles. So soon as the basaltic country through which Fossilbrook takes its course had been passed—which, for the first few miles, was over a flat country covered with reeds and rushes, intermixed with grass, and, after this, is contracted into a well-defined creek, with basaltic banks: an instant change takes place in the character of the country, which now becomes sandy, poor, and broken into stony ridges; the timber and grass change in character, the ironbark and bloodwood of the former are replaced by the tea-tree and other trees common to a sandy soil, which has been formed by the atmospheric influences acting upon sandstone and porphyry rocks, which here replace the basaltic formation. The aspect of the country proclaims itself in its productions: the short silver grass of the rainy season growing on a few inches in depth of sand, on a rocky bed, is dried and withered on the instant that its chief source of nourishment is withdrawn by the first hot sun; the ridges produce nothing but coarse grass, which shares the same fate; and, but for the beds of rivers and creeks, which also extend their influences to a short distance beyond their limits, the feed for animals would be of the most wretched description imaginable.

From my third camp, which was on the Lynd, I took my course for the Kirchner Range, which bore in a north-west direction, and reached it in two days at a distance of 15 miles from the above camp. The course of the river was kept in sight as far as the nature of the country would permit; but this was for miles so broken and stony, that it was most painful travelling. Our course was over sandstone and porphyry ridges, abutting on the river: for many miles we had to walk and lead our horses, owing to their rough, broken, and precipitous character; and in other places the tomahawks had to be brought into requisition to clear a way through the scrubby timber growing on these ridges. It was not possible to keep in the bed of the river; the travelling there would soon have been brought to a stop, owing to the river being cut up into numerous channels, the banks of which were covered with tea-trees and shrubs, and the beds with large slippery boulders and other stones, which the horses could not have faced. The closing in of the ridges on either side would have made it more impassable, as it would here partake of the character of a gorge which falls in the bed.

The formation of the country for the last four miles before arriving at our camp in front of the Kirchner Range (which is on the right bank of the Lynd) had changed to mica and hornblende schists, crossed by dips of greenstone: quartz was visible over the whole face of the country, and, altogether, its aspect was encouraging for the object I had in view. The range itself is a bold and conspicuous feature in the country, and, abutting as it does on the river,

cannot fail to attract the notice of those who may be following its downward course. My camp was on the left bank, right in front of the range; the river at this point was 330 yards in width, cut up into numerous sandy and stony channels, with vegetation on their banks, while the country in the immediate vicinity of the river afforded good feed for my horses and sheep. This camp was made out to be in lat.  $17^{\circ} 22' 0''$ .

On the last day of the journey to the range I had the very great misfortune to lose my prismatic compass lent by me to Mr. Warner, to enable him to take the bearings of the conspicuous natural features of the country on our route. Two searches—the last one carried out by myself—were ineffectual; and I believe that it fell into the hands of natives who were seen on our track the day of its loss, and who, no doubt, were watching all our movements. I have no doubt, myself, that so soon as Mr. Warner had risen from the ground where he was making an entry of his observations, the spot was visited by the blacks—the compass seen, secured, and walked off with. Its loss was greatly felt by me on many occasions afterwards. These were the first natives seen by any of the party.

Having resolved to remain here a few days to carry out my object, I made this a sort of permanent camp for the above period. On the afternoon of the first day after my arrival here, I started off with Dr. Tate to prospect a ravine near the camp, but we were not successful in our search for gold—the pannings off only showing black sand and garnets—the latter small, but in great quantities. On the following day I requested Mr. Warner and Dr. Tate to return along our route, the former accompanied by Jerry, to search for the compass, in the first place, and prospect afterwards; while Dr. Tate was to prospect some good-looking gullies passed over by us on our way here. The search for the compass was ineffectual; while the Doctor has no better success than yesterday—black sand and garnets being the result of all pannings.

On the morning of the third day most of the party accompanied me in my ascent of one of the hills forming the Kirchner Range, from which I had an extensive view to the north and north-north-east, as well as to the south. The former showed me a large tract of broken and undulating country over which I had to travel with the Expedition, while the latter an extent of country of a similar description for 15 miles to the foot of a range bearing south-west from my position. In the afternoon I proceeded 7 miles in the above direction, and found the country to be of the same formation as that we were camped on, and appeared to continue so to the foot of the range. During my absence Mr. Taylor and Mr. Nation proceed to a remarkable bluff about 4 miles east of the Kirchner Range—not mentioned by Leichhardt—but in itself a most notable feature of the surrounding country;—they had some little difficulty in ascending its western face, which was mostly precipitous; while, half-way up, there was a cave, which from its strong odour and appearances indicated it as the resort of kangaroos and other wild animals. From the summit of the bluff, which I have named Gregory's Bluff, after the Surveyor-General of the Colony, Mr. Taylor reported the same aspect of country to the north, as seen from the Kirchner Range; while to the south was seen the broken and abominable country passed over with such difficulty on the way to my present camp. Mr. Warner and the Doctor were engaged in prospecting for gold, but with the same results as heretofore.

I must confess that the results of all the prospectings were not very encouraging, but I devoted two more days to it, with the hope that something might be struck at last. The first day was entirely given to this by all excepting Mr. Stewart, who had the care of the horses and sheep. The second day was devoted to the same work by all excepting myself. I was determined to make another effort to recover my compass, and went in search of it

with my blackboy, but to no purpose—while the prospectings were equally barren of success.

I had now been five days on the Lynd, during none of which had I been successful in the great object of my wish; and as I found I had no more time to devote to this, I resolved to close my search for gold. However, this was not hastened on account of Mr. Taylor giving it as his opinion that it was not a gold-producing country, but simply owing to my party being too small to prosecute a search over such an immense tract of country, which would necessitate the loss of time—and this I could not afford to do, considering the task before me. I am strongly of opinion that this country is well worthy the attention of gold diggers, notwithstanding the adverse opinion of Mr. Taylor.

On the 5th July I quitted the Kirchner Range, to resume my journey. The general course was north; this cut the range in front of my camp, where a creek forming a gap gave me an easy passage. On the second day after leaving the above range, I struck a river coming from the south-east, which I have named "Tate," after the Doctor on this Expedition. The formation of the country, up to this, was similar to that of the Kirchner Range, and the character was more or less good and bad, according to its natural features. The first few miles consisted of easy travelling over quartz ridges, with iron-bark, bloodwood, and apple-gum, after which the party got into a creek, which threw it out of the course I was desirous of following; it was followed, however, in a north-west direction, simply because we could not get out of it, owing to the mica-schist hills hemming us into its bed. We were fortunate enough to get water for the night, when, on the next day, I reached the Tate in  $1\frac{1}{2}$  mile. The distance between this river and the Lynd I estimate at about 16 miles.

The meeting with so large a river at this point, on my northern course, has convinced me of an error which I made, when in my letter to the Government of the 26th June, after my return from a trip to the headwaters of the Lynd, I stated that I had been on the "Mitchell" watershed. Observation has now proved to me that I was in error on that occasion, and that the considerable stream on which I, on that trip, found myself, was no other than the Tate, which I believe to join the Lynd about 20 miles below the Kirchner Range.

On the 9th July, the fourth day after leaving the Tate, I struck another large river, which I have named the Walsh; and here I would beg to state that I have no wish to lay claim to being the discoverer of this stream or any others which are laid down on the chart. I found them without names—these I have given to them simply to prevent confusion when spoken of, and in order that the charts of the colony may be properly filled up with designations to natural features hitherto not named. The discovery of this and some of the other large streams on my line of route are entirely the fruits of the great and memorable journey undertaken by that courageous but unfortunate explorer, Kennedy, who lost his life just before the completion of his stupendous task, and that, too, within sight of the relief which was awaiting him. I have no desire to pluck a single bay from the chaplet which surrounds his memory as an explorer.

The general course between the Tate and the Walsh was still north. The first day I struck a creek which now showed a sandstone formation in its bed; here we had some difficulty in procuring water, which was found in the creek, after clearing out a dirty native hole, while the horses fared as well as they could on a small puddle in a clay-pan. The party surprised a native gin, with a baby—she took a tree—and it required great persuasions, on the part of the Doctor, to induce her to descend; but not before she had received his persuasions in a not very flattering manner. Either her stupidity, or that of

my native boy, compelled me to pack up, and move, the next day, for the want of water; but scarcely had I gone half a mile when I found it in abundance, and carried it along with me in billibongs to my camp, 3 miles further on. Four other natives were surprised here by the Doctor, but they ran off, leaving their all behind them. When the journey was resumed, the following day, the creek, named by me Nonda Creek—this being the spot where this fruit was first met with by my party, and is so often spoken of by Leichhardt and the Jardines—was followed until its course began to bear away too much to the westward, when it was abandoned and crossed, to pursue a north course through a sandstone scrubby country, which led the party to the head of a small creek running in the direction desired, and which brought it upon the steep banks of a river a quarter of a mile in width. This was the Walsh, so named after the Minister for Works, to whose patronage and countenance the Expedition owes its existence.

This river had a very grand aspect where we first struck it; it was enclosed on both sides, as far as the eye could see, within steep, red, and precipitous banks, making fine views for an artist; its bed was wide and sandy, carrying vegetation of various tints. I found a track into it without any great difficulty, and determined to camp on it for a few days, to enable me to explore its upward course. I estimate the distance between the Tate and the Walsh at about 26 miles. Before entering upon an examination of the river upstream, I devoted a portion of the day, after the arrival of the party upon it, to examine a short distance up and down stream, where I found that the precipitous banks did not continue far either way; that the country bordering the river, and on the top of these banks, was open forest, carrying ironbark timber, which appeared to extend some distance back; whereas, in other directions, the country appeared to break up and become scrubby.

On the 11th July, the third day after arriving on the Walsh, I was accompanied by Mr. Taylor and my blackboy in the trip up the river. In 9 miles, south-east, a small table-topped hill was reached, composed of sandstone resting on mica-schist; the river then took an east course, when it was crossed, and a tributary was met within 6 miles, crossing from the south. I was here of opinion that we were on auriferous country, but Mr. Taylor thought otherwise. In 4 miles, on a south-east direction, a mica-schist hill was reached, from which, in other 9 miles east, another hill of the same formation was ascended; near it was a small stream discharging itself out of limestone. In  $1\frac{1}{2}$  mile from this position three small hills were reached, composed of magnetic iron, and in the immediate vicinity of limestone. I found this latter to be similar in character to a like formation on the Broken River, running into the Clarke, a tributary of the Burdekin. In going north, the river was again cut, when some dreadfully rough country was traversed, so much so, that we had to dismount and lead our horses over it for miles; as the prospect to the eastward was not favourable, the idea of following the river was abandoned, when it was crossed, and a course of west adopted, which in 8 miles of moonlight travelling came to a creek which had water; the creek was then followed, during daylight, for 4 miles and abandoned, owing to its northerly course, when in 8 miles more the camp was reached, where all was found to be in safe order. The members of the party remaining in camp had been very successful in fishing.

The results of this trip cannot be said to have been great; they were the possible existence of auriferous country (on this opinion was divided), and the certainty of good pastoral country, to the extent of 100 square miles, bordering on the limestone formation.

Having completed and satisfied myself of the nature of the country up the Walsh, I resolved to move on, which I did on the 15th July, by following down the right bank of the river for 3 miles, through a poor country; here I

came upon a limestone formation, which I found to be similar in character to that on the Flinders and the Barcoo. In passing over the ridges I noticed some fossils, which at once induced me to draw up and prosecute a further search. The camp was fixed on the steep bank of the river, which here presented banks 60 feet in depth, composed, near the surface, of a light calcareous soil a few feet in depth, resting on a deep bed of shale, in which limestone boulders of all sizes were imbedded and suspended, and in which the fossils were mostly found.

A more interesting spot for a scientific man can scarcely be conceived; here he is surrounded by the objects of his interest, they are under his feet like pebbles on the seashore, they are hanging above his head ready to crush him if not careful, he cannot move without seeing them around him on all sides; they were of all sizes, and numbers of them beautifully perfect. What, and how many to save was the puzzle, each new find exceeded the last one in beauty, until all the beautiful ones were sufficient to load a dray, could we have saved them, and, as I had not even one packhorse to carry these and the rock specimens, I was put to my wits' end how many to transport. However, Mr. Taylor and myself collected the best of the various species, which we were content to secure and carry along with us. I found two or three bones of the vertebrae of a large animal, which were attached to each other by limestone.

It would have required more time than I had at my disposal to devote to this most interesting search, which would, no doubt, have led to the discovery of successive beds of deposits, showing various other forms of extinct life; but I had a great task before me which needed time to accomplish, therefore I had to be careful of it.

After devoting one day to this search for fossils, I moved on on the following one, on a general direction of north, along the course of the river for 9 miles, where I found no traces of the limestone formation; then in 3 miles crossed a creek which had been met with by Mr. Taylor and myself on the 13th previous, and which I have named Elizabeth Creek. Here limestone again appeared in patches; in 3 miles another creek was crossed close to its entrance into the river; 2 more miles brought me to another creek, to which I have given the name Louisa Creek, and here commenced as fine a piece of pastoral country as any I have seen in Queensland. The formation was limestone, soil deep and rich, timbered with mimosas and bauhinias, and carrying many grasses common to the Barcoo. Eight miles of this country was terminated by a creek, which changed the character to open forest with rich alluvial soil, when in 3 miles a fine running river, 300 yards in width, was reached coming from the north. I estimate the good land on this river at about 500 square miles. From a hill near Louisa Creek, which I take to be part of Kennedy's Pebble Range, the Walsh was seen bearing away to the west.

I determined to remain on this river and ascertain its identity, also to fix, by observation, its junction with the Walsh and the Lynd. On the 20th July I left my camp, taking Mr. Warner and the sextant, and my blackboy with me down the river. In 8 miles the Walsh was reached; the junction was found to be in lat.  $16^{\circ} 24' 39''$ . Continued along the river for 31 miles further, when the Lynd was made. Leichhardt's faithful description of the junction proved to me that I was on the Mitchell; I was not surprised at it, my opinion being in favour of it. Although the chart made this river further on towards the north, the junction was ascertained to be in lat.  $16^{\circ} 23'$ . The nature of the country between the two junctions was of the poorest description, being conglomerate and sand to the river bank. Trees were marked at the junction with my initial H, and broad-arrow.

The return to the camp was made on the opposite side to that on going down the river: the first 18 miles were well grassed, and free from floodings—

timbered with mimosa, bloodwood, and stunted gums, and splendidly adapted for pastoral purposes; similar country appeared to stretch far to the north. A creek now changed the aspect entirely, bringing with it sandstone and conglomerate, and the timbers common to this poor formation, which, in 21 miles, brought me to my camp. Natives were seen on this journey, but they were gins and children: fishhooks given to them.

The results of this trip may be said to be, the fixing of the points of latitude of the junctions between the Walsh and the Mitchell, and the latter with the Lynd, which, I trust, will be deemed of some importance towards completing and fitting up the chart of this immense tract of country in Queensland; also the discovery of a fine tract of pastoral country on the right bank of the Mitchell, stretching north.

Having secured the objects of this journey I resolved to move on, which I did on the 24th July. In about one mile had one of the most beautiful views of the river imaginable: it lay at our feet, at a depth of between 50 and 60 feet, hemmed in on both sides by dense foliage of every possible tint of green; it rippled in its whole width over a fall of between three and four feet depth, and stretched away out of sight in an unbroken line of vegetation. The scene was a beautiful one for an artist. Nine miles brought me to a mica-schist bar, stretching right across the river, which, during floods, must make a most imposing waterfall. The river was still followed for other eight miles, when I resolved to form a camp for a few days, to enable me to explore the upper part of this river with a portion of the members of my party.

The river-bed here showed large quantities of drift-slate, quartz, agates, cornelians, and other stones and rocks: it was running a strong stream still. Tracks of crocodiles were seen in numerous places; fish were caught in abundance. I believe the natives to be in great numbers about this river; their camps were numerous, and everywhere, and full of mussel-shells. These bivalves are very plentiful in this river; in fact, I believe them to be the chief food of these people. The distance between this camp and the first one on this river is 18 miles: the first part of the travelling was over a good country, it then became broken near the river by the small creeks coming into it, which made it severe on the horses. So far the river had kept my course of north, but now it was deviating from it, so I determined to follow it no longer with all my party. It was necessary that some horses should be shod, which I did before starting.

On the 27th July I started, accompanied by Mr. Taylor and Dr. Tate, to follow up the Mitchell, which I did up its left bank. We first met with eight miles of good basalt country—here was the source of the agates, which were all of inferior quality—then came two miles of limestone formation, with excellent grass; then three miles of slate country, with worthless grass: a range was examined, on passing up which Mr. Taylor characterised as carboniferous, and named it "Taylor's Carboniferous Range;" then came 15 miles of the most dreadful country that any one could desire to travel over—the horses were stumbling about in all directions, owing to the sharpness and ruggedness of the slates: in one instance the ridges closed in on the river, making them impassable; we then had to descend into the river, and scramble out through a gorge. A remarkable range on the south side I named Warner's Range: it had been visible to us for a long distance, and it was some of its peaks which I named Warner's Peaks on a former occasion. Ten miles were then accomplished on a south-east course, to try and avoid the slates; but we had to return to our camp: it was impossible to pass over the slates, which were as sharp as knives, and from three inches to three feet in height; the horses winced over them—they should have leather under the shoe to protect the frog from the cutting slates. Here an attempt was made to cross the river, but found impracticable, owing to the numerous bars crossing the river, over

which the horses could not travel : the stream here was 50 yards wide, with from two to three feet of water. All further progress upwards with the horses was impossible ; I therefore waded across with Dr. Tate, and proceeded on foot to a hill seven miles off, if possible, of a rougher character than hitherto : from it, at a distance of 20 miles in a south-east direction, a conspicuous mountain was seen, which I have named Mount Lilley. We could also trace the river coming from the same direction for a distance of 30 miles, and apparently from the Bellender Ker and other ranges in its vicinity. I could not afford the time to explore this river further, which I much regretted : to have done so was to turn my back on the work before me, which lay in the north and not in the south ; but I nevertheless think that this exploration is well worthy attention, as the slates were changing and the quartz appearing in large quantities, while in the distance the aspect was altogether more favourable in all respects. The walk of 14 miles was the severest I ever had.

Since leaving the permanent camp we have gone 45 miles up this river, only to be baffled and driven back ; the horses had dropped shoes and were jaded in appearance, owing to the character of the country, on which the feed was utterly worthless. Got back to my party on the evening of the fifth day, when we were all glad to be together again. Mr. Warner made this camp in lat.  $16^{\circ} 16' 59''$ .

On the 1st August I resumed my northern journey. The river was crossed a little above the camp, when in eight miles I came upon a creek, on which I camped, and caused some prospects to be washed, but without any signs of gold : the formation was mica-schist, yielding, as usual, black sand and garnets. At three miles' distance due north was a remarkable mountain, which I have named Mount Mulgrave : it forms the most conspicuous feature in this part of the country, rising as it does to the height of thirteen or fourteen hundred feet out of the flat surface surrounding it. I ascended it in company with Mr. Warner; the attempt was most difficult to accomplish. Owing to the loose and rotten surface, we had frequently to bring our hands and knees in requisition, while the descent was equally difficult and dangerous. The mount is the termination of a range running north and south : to the south and west it ends in precipitous sides, which gives it a bold and magnificent appearance. As a view for a photograph or painting it is unique ; it is composed of slate, surrounded by a mica-schist formation. Eight other miles of this country, intersected by a creek, which was prospected with no good success, brought me to the head of a creek in a sandy country, which was followed for nine miles north, when it was left ; when another one and a half mile brought the party on a large running creek, which I have named Garnet Creek, owing to the large quantity of these valueless gems being found in the sand : in places these could be swept up in handfuls. The observation of the sun made our camp in lat.  $15^{\circ} 51' 59''$ . Three miles from the camp was a high hill, with perpendicular sides, which I have named Mount Daintree : it is composed of sandstone and conglomerate, resting on quartzite. From its summit a large river was seen to the north, distant about three miles from the camp, which I believe to be the Kennedy's Ninety-Yards-Wide Creek : this I have named the Palmer, after the Chief Secretary of Queensland. The country between Garnet Creek and the river is poor and sandy, timbered with iron-bark and other trees found on poor soils. The distance between the Mitchell and the Palmer I estimate at about 29 miles. The camp on the Palmer was fixed in lat.  $15^{\circ} 49' 14''$ .

During the early part of the journey I promised half-a-pound of tobacco to the first person who should find gold—knowing this to be an invaluable article to persons given to its use, and because I thought it might act as an incentive to prosecute the search for it. Mr. Warner claimed the reward, producing the proof of his right to it. I satisfied myself by personal inspection of the locality,

and the washing of several pans of dirt, that the gold was found here, so I handed him the reward. The gold was found in a gully named Warner's Gully, also in ravines falling into it; but, so far, I only look upon them as indications showing that the metal existed, without being profitable to work. The prospecting was continued, with equal success, for three days, simultaneously with an inspection of the surrounding country: that down the river was pronounced unfavourable, while upwards was the direction indicated by Mr. Taylor as being the most likely one to lead to far greater success than hitherto, his opinion being that the gold had been brought down from above, where, perhaps, a change in the formation of the country would be likely to lead to better results. The character of the gold was light and scaly, though rich in colour, and had been subject to the action of water. It was found on a granite formation.

And I would beg to mention here that Mr. Taylor now gives it as his opinion that gold might possibly be found all across the country, from Kirchner Range to the Palmer, nearly the whole of which is of mica-schist formation; whereas, before this discovery, he maintained that this formation would not yield gold. I leave him to reconcile these statements, and his change of opinion.

Having discovered the traces of gold, I was not disposed to rest satisfied with such a bare fact, but determined upon devoting a few days more to satisfy myself of the extent of country over which it could be found, and also whether it could be found in payable quantities. With this view I moved up the river in three stages, carrying the indications with me as far as 15 miles, where I resolved to form a camp for a few days, and push still further up with the same object. Numerous prospects were made on the bars of the river, many of which were encouraging, supposing the facilities to exist here, which are to be found under similar circumstances in other places. We had now got out of the mica-schist formation into that of slate. This camp was placed in lat.  $15^{\circ} 52' 34''$ .

On the 13th August I proceeded up the river, accompanied by Mr. Warner and my blackboy, when we ascended it for 30 miles, entirely over a slate-formation. Prospects were tried all along our course, all yielding traces; but, at the furthest point, the country became similar to that which baffled me on the Mitchell, so I abandoned further search in that direction. The natives showed themselves here, with an evident desire to be troublesome, as they fired the grass on all sides of our camp whilst we were saddling up; but on our going towards them they withdrew. Our course up the river was a little to the south of east. Having satisfied myself that I could not proceed any further, but that I had taken the traces of gold so far, I retraced my steps to my fixed camp, which I reached on the fourth day of my absence from it.

On my arrival in camp, the bad news awaited me that my last seven sheep had strayed away and could not be found. This was by no means pleasant tidings, as they were equal to four weeks' meat for the party, and I had very little hopes of seeing them again, considering the time they had been away. However, I resolved to send Stewart and my blackboy in search of them, with the view of learning whether it was possible to recover them. Fortunately this was done, owing to Jerry's intelligence and perseverance, which Mr. Stewart said he never saw equalled in any blackboy. They had gone back over 15 miles of a rough country, where, in places, they left no visible tracks to ordinary eyes; but this boy's unerring sight and instinct led him on to the recovery of the sheep, which were found on one of the steep spurs of Mount Mulgrave, making right home for Mount Surprise, where they had been bought, and which they would have reached if not disturbed by wild dogs and natives. Finding these sheep relieved my mind of a great deal of uneasiness. Without them, it was doubtful whether I could proceed without replacing their equivalent in meat,

which I could not procure nearer than at Mount Surprise. This would have necessitated a delay of three weeks or more, which was a serious consideration to me. I also found one of my horses away, owing to the negligence of one of the members of my party; but as I had warned him of the consequences of such neglect, and this being the second occasion on which a horse had been lost by his carelessness, I informed him that I should hold him responsible for its value. The horse I have never recovered.

It was with great regret that I felt myself compelled to leave this river without first finding something more substantial and lasting than flattering "prospects." I was in great hopes at first of having done so somewhere within the two points of where I had met with the traces of gold and the last where I had parted with them; but my hopes and endeavours were not gratified with success, which were only second to my disappointment. But it does not follow that there is not gold in this region somewhere, and I believe that it must be sought on the confines of the slate, with some other formation; and on the sources of the Mitchell and the Palmer the gold found by me I believe to be the lighter particles washed down ages ago from sources where it exists in larger quantities.

But the task to penetrate this country would not be an easy one: its rugged nature would, I believe, necessitate an examination of the track in the first instance, as to endeavour to cross the slates after my experience of them would be madness. I know what my horses suffered, and I should be sorry to inflict a third trial upon the poor animals. However, by a *détour*, the slates might possibly be avoided, when the country which I saw from my furthest point of observation on the Mitchell might be reached and successfully prospected for gold. I wish to be very guarded in all that relates to these discoveries. I trust that nobody will be led away by anything that I have stated to jump to the conclusion that it is here in payable quantities. My desire is chiefly to impress upon all that in this direction there is as good-looking a country to prospect for gold as any that I have before seen; but I do not promise its existence, and I would, moreover, caution any but well-trained and experienced bushmen to venture into this country, of whose outlets nothing is known—any but such might find themselves in difficulties, out of which it would not be easy to extricate themselves. The horses would require to be constantly kept shod, and the men should be of self-reliant and courageous natures, in which case the difficulties of the country might be faced.

On the 19th August I retraced my steps to my first camp on the Palmer, which I reached the same day. On the second one, I devoted half a day in a fruitless search for the lost horse; the animal had evidently quitted the river, otherwise traces of him would have been seen. I omitted to mention that on our way up the river signs of cattle were seen by my blackboy, in the shape of dung not many days old; but a hunt for them did not lead to their discovery. This I regretted, as it deprived me of a further supply of meat, which I should have been glad to secure. Devoted the rest of the day to shoeing horses for the northern journey. Early in the morning, visited and surprised a native camp, in which the natives were all asleep. Their terror on awakening added wings to their speed, when in a moment the men were out of sight amongst the brushwood. My object was to learn something respecting the cattle-tracks, but the continuous howling of the women and children—which nothing would pacify—compelled me to withdraw, which I did after giving them some fish-hooks in return for their diabolical howling.

On the 21st August I started on my northern course. I resolved to make one other effort to recover the lost horse, when I told off Mr. Warner and Jerry for this service, with directions to beat round our camps up the Palmer, after which they were to overtake me on the following day. On the third day after the Palmer, I for the first time came upon eastern waters, but, as I did

not wish to follow them yet, I returned to the western slope, and kept that fall until reaching the Main Dividing Range, which was reached on the 2nd September.

The nature of the country passed over between the Palmer and the last-named locality, on a general course of N.  $30^{\circ}$  W., was poor in the extreme, consisting mostly of flat sandy ground and strong ridges; forest land, with magnificent timber, was passed through, consisting of stringy-bark and blood-wood, with other forest trees common to this part of the country. During the first day's stage from the Palmer, quartz was seen in large quantities, but the country on the whole was worthless. During this stage an important river was met with in 69 miles of travelling from the Palmer, although not in a direct line, which I have named the Coleman; it had scarcely any water in it, but at our camp, just at the junction of the river with a creek whose course was south-west, the latter had a large supply. I assured myself of the course of the Coleman, by following it down for 7 miles with Mr. Taylor, at which point it was going south-west, and from a hill composed of mica schist, in which garnets were largely embedded, near the camp, it could be traced for 15 miles, still pursuing the same course, which was sufficient to prove it a Mitchell water; quartz was met with in large quantities in this neighbourhood. The camp on the Coleman was in lat.  $14^{\circ} 45' 59''$ . The course of the river here was north.

The Coleman was followed up for 17 miles—owing to its being on my course, but then abandoned because going out of it; the second camp on it was badly supplied with grass and water, consequently the horses suffered, as I had to keep them close hobbled. After crossing it, and at a distance of a few miles, some more cattle-tracks were met with, which brought us to one of their deserted camps, where the recent use of it was clearly proved by the fresh dung lying about; these cattle were no doubt lost by the Messrs. Jardine, on their famous trip to Cape York. I camped on a creek which I think will be the Kendall of the above gentleman, and remained on it one day, with the intention of securing one of the beasts if possible; but in that I was not successful, owing to the animals having abandoned this beat for want of water; I had no time to devote to a longer and further search. Some natives, while passing the camp, were invited to stand, when a friendly intercourse was exchanged; they are a good-looking race, insomuch that they do not preserve the hideous features of the natives of the south. These people have well-shaped noses, moderately-sized mouths, and sufficiently well-formed foreheads, to redeem them from ugliness. I gave them a few fish-hooks when the interview terminated; they showed little signs of fear. A conspicuous hill on my course was named Mount Newberry; it has been my guide so far. Ten miles from the supposed Kendall brought me to a flat covered with mimosas and banksias, where observation made our camp in lat.  $14^{\circ} 13' 4''$ , and from this, in 7 miles, making in all 48 from the first camp on the Coleman, we were on the crown of the main divide between the eastern and western waters, and the northern limits of our journey.

Here we were at last at the termination of our northern course; of the country passed over and behind us nothing could be seen, but the recollections were pleasing. So far the trip had been one of pleasure, as the travelling, on the whole, had been easy; our larder had been well supplied with kangaroos and fish, nondas and wild honey, and if our search for gold had not been as successful as we could have wished, it had for the time been exciting. I am at a loss to conceive how men can call exploring "monotonous;" there is not a hill that does not create interest—there is not a creek or a river that does not lead the imagination to think where it may go, what it may lead to, or what it may contain; there is not a goal or a haven looked forward to that has not some interest interwoven with its locality—it may possess the footprints

of some travellers who have made a name for themselves, and surrounded it with the halo of discoverers; it may lead across the path which led them to their final resting-place, after having battled against nature, which at last beat them; it may even lead to a sight of these last resting-places of great hopes and baffled expectations, which should alone make one pause and reflect on one's own future fate in the wilderness. There is not a bushman who does not look forward to the end of a day's travel with interest and anxiety; it may lead him to a pleasant country where all is agreeable, or it may lead him into one of the difficulties and dangers which may tax all his perseverance and stout-heartedness to overcome, and even with these he may be compelled to stand and surrender. Has it not been so, can be answered by the fates of innumerable travellers known and unknown to fame. And yet there were one or two members of my party who considered exploring "monotonous;" they "ate their suppers and went to bed dreaming of their breakfasts—they rose in the morning, ate their breakfasts, and then passed the day thinking of their suppers!" Is comment on such men necessary?

If the journey hitherto had been comparatively an easy and a pleasant one, the view which now presented itself from the summit of the Main Range went far towards dissipating ideas that such would continue to be the case for the future; the expedition was now entering upon a land of mountains and floods. The view to the north extended over high mountains and ranges, suggesting the arduous journeys and melancholy fate of the great explorer Kennedy; to the east the land was low, and evidently skirting the sea, which was not in view, while to the south, which was to be my future course, or nearly so, I saw mountains on every side, and above one another to the horizon. I had seen sufficient, and now commenced my homeward journey, leaving it to time and fortune to decide how it would terminate. The descent from the range—here low—was short but rough, over a granite formation, to the head of a creek, which fast assumed the proportions of a river, which brought us into Princess Charlotte's Bay. At the head of this river, which I have named the Stewart, and which is Kennedy's River, 100 yards wide, many varieties of plants were seen—not met with before—and offered to an enthusiastic botanist a wide field for research; some of them were exceedingly beautiful in appearance. The first camp, 5 miles from the summit of the range, was fixed in lat.  $14^{\circ} 2' 34''$ .

My camp in Princess Charlotte's Bay was reached in 27 miles from the top of the range; the country was poor, and may be set down as second-class pastoral country; it is abundantly watered, and subject to floods on the lower lands towards the coast; it is timbered with ironbark on the ridges towards the Main Range, and with tea-tree lower down, which is again scrubby, but open on to the coast. The sea was reached by me—accompanied by my blackboy—in  $1\frac{1}{2}$  mile from the camp, the track being over-flooded and open scrub-land; the coast presented the most dreary aspect imaginable, the sandy beach and breakers extended as far as the eye could see, north and south: this prevented Mr. Warner from fixing the latitude of the mouth of the Stewart, as he could get no water horizon; there was nothing of sufficient interest to keep any one of us long on the sea-shore. I made a short excursion on the morning of the third day before starting, which was delayed by the straying of two of my horses, when I proceeded north for 6 miles, which brought me to a creek from which, finding that the aspect of the country beyond was similar to that passed over between the camp and my standpoint, I resolved to turn my back on the north and hasten to my camp, where all were anxious to quit this cheerless spot. The camp was in lat.  $13^{\circ} 59' 49''$ ; the artificial horizon was a bucket of water; this has been adopted for some time past. I will just mention here that Mr. Warner and I have our doubts as to the correctness of the observations—owing to the derangement of the sextant—believing that we

have been all along 6 miles to the south of our supposed positions, but this we have no means of proving.

On the 6th September I left the Stewart for the Kennedy, taking a south-east course, which I reached in 48 miles—the generality of the country was poor; one spot was passed which presented the most beautiful appearance I ever saw. It was a broad and shallow watercourse during rains, but now dry, composed of rich soil, and large trees, with foliage of various tints of green, and so dense that beneath them it was perpetual shade; here also was under-growth equally rich in appearance, and the two combined made it a beautifully cool and fresh-looking spot. There were also many miles of open forest land, with splendid timber of the stringy-bark species, magnificently adapted for telegraph poles, if found in a situation where they could have been made available. Here I dropped my first horse, as it could proceed no further; it had done no work for some time past, and I believe was reduced to its present state from the effects of eating some poisonous grass or herb during the journey. I also lost my two last sheep for a time, but fortunately Jerry again found them three miles from the camp; but I had sealed their doom, which was not far distant. In coming across, had to dig for water for one night's camp, which was easily procured at a depth of 2 feet, in a clump of dense tea-trees. I had drawn up into camp 4 miles back, but the horses were rambling in all directions over recently-burnt country, which compelled me to pack up and move to this water, where I had fine feed for the horses. All the country about the Kennedy had been recently burnt, the consequence of which was that there was no grass, excepting at a lagoon, where it was good, and in sufficient quantity to last the time I intended remaining on the river.

I devoted one day in an examination of this river down stream; shortly after breakfast I left, taking my blackboy with me, when, in  $2\frac{1}{2}$  miles, I came to a sandstone-grit bar, stretching right across the river only a few feet lower than the surrounding country;—at this bar I met with salt water at the lower end, a pretty sure proof that I was within the tidal influence. I crossed the river here, and went south-east 3 miles, then altered my course to the north for 5 miles, over plains showing flood-marks from 4 to 6 feet in depth; and from a sand-hill in the vicinity I found the surrounding country to be all of the same character. There was no necessity for my carrying my examination any further, as the country was totally unfit for all purposes of settlement—the approaches to the sea would of course be worse. The sandstone bar was a crossing-place for the natives, their paths radiated in all directions from it.

The peculiarity of this river consists in these bars—they are miles apart, but between them there is one continuous sheet of still water of great depth—in places the banks slope gently into the river, while in others it is composed of sandstone with perpendicular falls of from 6 to 10 feet; it is about 100 yards in width; the banks are free from the dense vegetation of these northern rivers, while beyond them are plains and open forest land, all subject to floods, and of the poorest quality of soil. The inundations are caused by these sandstone bars acting as dams, which throw the waters over the surrounding country owing to their being only a few feet lower than the banks of the river; and when I consider what a volume of water has to find an outlet, I am not at all surprised that these impediments cause the country to be a sea of water during the rainy seasons. Fish were not caught in great numbers; alligators were here, Jerry having heard one during the night; altogether, the river and the surrounding country had a forlorn look. Near the camp were one or two of the most beautiful clumps of palms I ever saw, making altogether a splendid object for a photograph. My two last sheep were killed to-day, so I have arrived at the last of my fresh meat. As I felt satisfied with the results of my journey down the river, I determined upon moving next day.

On the 12th September I started, following up the course of the Kennedy at south, crossed two branches, and then on a course of south-east, at a distance of 13 miles from the crossing of the Kennedy, I found myself on the banks of a magnificent running river, with steep banks free from scrub, and with an average width of 100 yards. At the first sight I put this down as the Kennedy, but my observations by sun, and my dead reckoning, soon dispelled this idea, as they made me considerably to the eastward of the track of the explorer of that name. This, therefore, was a new and grand river; and I gave it the name of Normanby. In coming across from the Kennedy, a vast extent of wretched and flooded country was passed over; about three miles from the Normanby, a swamp was passed covered with geese and other wild fowl. During the rainy season I believe these two rivers to be nearly connected to each other by swamps, lagoons, and backwaters. I found myself at a very good crossing-place, which I availed myself of, and passed over to the opposite bank and camped.

On the following day I proceeded down the river, accompanied by Mr. Taylor and my blackboy, when I followed its course down for 13 miles, and found that the country was similar to that on the lower part of the Kennedy, with the exception that here the floods showed marks of 15 feet above the surrounding country, consequently what footing was there for man or beast during the seasons of floods? This same country extended, no doubt, to the sea, where it was met by mangrove swamps in the southern bight of Princess Charlotte's Bay. But for these vast inundations, the country would be splendidly adapted for cattle stations, owing to the numerous swamps, lagoons, and backwaters, dispersed over the whole face of the country; but, considering that the floods vastly exceed the quantity required to keep these supplied with water, it is at once rendered a waste. I was satisfied with my journey down the river, so far as its adaptability for settlement was concerned, when I returned to camp, which I reached the same night at 11 o'clock. Some low sandstone ridges were seen a short distance back from the river-carrying stringy-bark, which would alone proclaim their character. I have not the position of this camp, owing to my instrument not showing a higher reading than  $142\frac{1}{2}$ , consequently Mr. Warner could not fix it by observation. Many natives were met with during the day, all amicably disposed; I made them presents of fish-hooks.

On the 14th September I quitted this part of the country, with a general course of south-east, when, in 43 miles, I again found myself on the banks of the Normanby, still a fine running stream. Between this point of the river and the last one the country passed over was wretched in the extreme; the sandstone grit was still seen as the formation, ridges of these came close to the river in one instance. A long picturesque plain was crossed covered with seedling gums, the deposits of floods; it was scarcely possible to believe, looking at the river enclosed in its deep banks, that this high and sound country could be flooded, but there were the marks showing from 6 to 8 feet of water to exist on it at times. After this the river branches; an unimportant one going to the east, which I crossed, passed large swampy lagoons, with bad grass, and plunged into 15 miles of scrub, which at 5 miles more brought me on to a creek with better grass for my horses. After this,  $8\frac{1}{2}$  miles of open box forest brought me to the river, passing a lagoon 1 mile from it, on which some natives were seen fishing with a net; they were gins and children.

This camp became a memorable spot, as here we nearly came into collision with the natives. The day before, Dr. Tate brought a native boy into camp with him, on front of him on his horse; the boy showed no signs of fear, neither did he display any reluctance to visit the whites—he was pleased with Jerry and Jerry with him. Shortly afterwards they went out wild honey

collecting, when Jerry found himself surrounded by the "mials," as he calls them, all very noisy and carrying spears. He soon made for the camp, and we all sallied out to his rescue; a little of the unknown tongues on both sides, with a few signs, arranged a peace, and the matter ended. The boy had joined his relatives and friends, and it was, no doubt, his recovery that the natives sought, not being aware, perhaps, that the boy was a willing visitor to the camp. However, I had my doubts as to their peaceable intentions, as I saw many of them retiring with evident signs of triumph at having gained their point, and I told my party that the next morning would more surely prove their intentions. And the next morning did do so, as, whilst Stewart and Jerry were out for the horses, two lots of natives simultaneously made their appearance from a dry lagoon and the river, with the evident intention of cutting off their retreat to the camp. The horses were quickly collected; spears were thrown at Stewart when retreating, and Jerry was making his tracks as quickly as possible towards the camp, while all were shouting and yelling at the top of their might; the horses passed at a thundering pace, and on came the blackfellows from every direction with bundles of spears each, and painted for mischief. "They mean it," was said by one, and certainly it looked very much like it. Jerry on his own hill was very bold; he now told them to come on. I collected my party together and sallied out to meet our enemies, who, when they saw us advancing towards them, stopped and drew close together, while the stragglers were coming up from every direction. I deemed this the proper moment to make a demonstration, and, with this view, requested two of my party to give them two long shots as a warning what nearer ones might effect, if they persisted in approaching us. The result was magical; every blackfellow turned and retreated with greater rapidity than he had used in his advance, which ended the affair. I was not sorry at such a termination, having no desire to come into collision with the natives, or to molest them in any way.

On the 17th September, after the morning's adventure with the natives, I packed up and travelled on upon a south-east course, and again cut the Normanby in 18 miles. On the first day a carboniferous range was passed, in the capping of which Mr. Taylor found some mollusk fossils; after this I found myself getting into sandstone ranges gaining in height, which necessitated an inspection before going further, as I had crossed the river once owing to their abutting on to its banks, and saw further on that I should be compelled to do so again if continuing the course of the river. This, however, was now coming from the south, as seen by Mr. Taylor from an eminence near the camp, and, as this was not my intended course, I resolved to leave it; its course was through an impassable and worthless country.

On the 21st September I reached the Endeavour in 29 miles. After leaving the Normanby, I crossed the sandstone range, keeping as near as possible a south-east course, where I found it to be  $5\frac{1}{2}$  miles wide, and terminating on my course in a steep descent most difficult and dangerous for the horses, but which was safely accomplished; this I saw brought me to another watershed, the sandstone range forming the divide between the Normanby and the Endeavour. Here, also, the slate formation first made its appearance, and continued through the whole of the country watered by the latter stream. At the foot of the descent the head of a creek was followed, in which I saw oaks for the first time since leaving Fossilbrook, owing to which I named it Oaky Creek. In descending the creek a remarkable range ran parallel with it to the north, composed of sandstone and slate, as proved by Mr. Taylor and myself in our ascent of it; the country was poor, with stringy-bark and blood-wood timber. The first shower of rain fell here; so far it had been dry. I followed the course of the creek, which was running east, as near as I could; but the rough country on either side frequently compelled me to cross and

across it; a little good land, 300 acres in extent, was seen, but unavailable, and where the Endeavour was first seen by me it was 300 yards wide, and salt. I found a crossing-place 1 mile further up, where it had contracted to 30 yards in width, running a powerful stream through dense tropical vegetation. In 10 miles from this spot, on an east course, I found myself within the influence of salt water, by meeting with this and the salt-water tea-tree, but fresh water was found just above these, where I camped.

On the 22nd September I proceeded in the direction of the sea with Mr. Warner and Mr. Nation, which we reached in 4 miles, and, as there was an abundance of fine young grass here, and also water, I brought my party to it on the following day to give my horses the benefit of these, as well as to give the members of my party a chance of roaming over historical ground as a relaxation from their work. Natives were seen by us frequently, but they were shy and would not approach us. I cannot account for this except by supposing that they have been fired upon by visitors, as it is not likely that they were equally shy with the members of the fishing party so long settled here, composed as it was of whites and kanakas. None of us met with any traces of our great countryman Captain Cook, who here careened his ship. The bay and its environs are exceedingly pretty; for a settlement it would be a charming place, being picturesque and compact, but, when this has been said, all has been said. From time to time the Endeavour has cropped up as being a wonderful place for many things; among others some fabulous ideas were afloat about its richness in gold. It has fallen to my lot to dispel these by pronouncing it, in mining phraseology, a complete "duffer"; it has no gold, no good land, nor anything beyond scenery and its pretty situation to recommend it. The slate formation is visible everywhere, the rocks on the sea-shore are composed of it.

On the 25th September I started off from the coast, intending to follow up this river to its sources, with a hope that it might lead to a better country. This hope was destined to fall to the ground, as 30 miles of travelling brought us to the utmost limit that it was possible to follow it. From the time of first reaching it from the coast it had been nothing but a series of laborious days for men and beasts; on its western side it is hemmed in by a steep range that persistently hugs it on that side, while on the eastern side the high and broken country did the same; consequently, the travelling was sometimes in the bottom, and at others along the face of steep mountains with precarious footing for the horses. Creeks came into it on both sides; the river was crossed five times, and every time with difficulty and danger, owing to the strong current and slippery nature of the bottom, which was strewn with large slippery boulders, which the horses could not see, and on which they were falling about, consequently they became frightened, and could scarcely be urged to move on; a portion of the way the whole country had been burnt, leaving them nothing to eat but old grass, which they would not touch. On recently burnt ground some poisonous herb makes its appearance in these parts, which is eaten by the horses, and from which many of them die: this befel my best riding horse; it died shortly after coming into camp, the day after it had eaten this herb. Two others were affected in the same way, but their fate was in the balance. My loss was a serious one in the position in which I found myself;—my horse was an old and tried friend that could drag me through great difficulties when called upon to do so, but now he was no more. On all sides I was hemmed in by huge mountains densely covered with scrub, through which I saw no outlet; everything tended to depress the spirits, but these were not allowed to fall, otherwise the work would have been shrinkingly undertaken. I pointed out to my party that here we were, and out of it we must find a pass across the wall of scrub intercepting our progress.

I sent out a prospecting party to follow a native path from this camp into

## ADDITIONAL NOTICES.

the scrub; it was followed for 2 miles to another opening in the scrubs, which it crossed, and again entered another scrub on the face of a hill which had a fall of 1000 feet into the level country below. The question naturally suggested itself to me—"Can this be done?" My answer to myself was—"It must be tried." The native path was cut and cleared through the first scrub; every man had his position and his work assigned to him, as on these depended the success or accomplishment of the work before us. I placed Jerry in front, with my team to lead and keep the path. I followed, driving three or four horses before me, when the others were to follow in rotation doing the same. A single horse threw the whole party out, when it had again to be brought into driving order: a single horse deviating from the path took others with him, when the whole were entangled in a mesh of vines from which there was no escape excepting by the use of tomahawks and knives; the thorns and "kunya" scrub irritated both men and beasts. At times it was difficult to get away from the close entrance of these latter; their long arms were drawn across the face, the hands, the clothes—they would not suffer to be shaken off; they required gentle and civil treatment, otherwise they kept their hold, and very much reminded me of other "lauyers" not found in scrubs. The density of this may be imagined when two horses, that had availed themselves of a hitch to get away, were passed and re-passed three times without being seen before they were found. They had, however, reckoned without their hosts; the "lauvers" there made them stand and deliver. But I am happy to say that the task was accomplished, which, at the same time, gave us a first taste of scrub travelling.

The open space between the patches of scrubs was equal to a paddock, but the feed was sour and bad, as evidenced by the appearance of the horses. The first passage was an easy one, being over a tolerably flat surface; but the next one was over a fearful descent upon the face of a hill broken up with rocks and ravines and intercised with roots upon the surface, which literally afforded no footing; a man could, of course, pick his way, but not so a horse. I went through the first day with some members of my party to examine the track, and reached the level country below; from thence we returned and cleared the path as far as we could that afternoon. So far the track could be followed, and the work of clearing was not much; but this brought us to the foot of the ascent, when our work commenced—the native path was cleared in places, in others it had to be deviated from and a track made capable of allowing a horse to travel: fallen trees had to be cut up, rocks to be removed, ravines to be bridged over, all roots and vines likely to trip up men or beasts carefully cut and removed—otherwise, perhaps, destruction awaited them. The work was most laborious, and had it been in the sun would have been unbearable; but we were in perpetual shade, which made it tolerable. The indefatigable Jerry found four scrub pheasants' eggs, which he cooked native fashion, and which we devoured notwithstanding that they had chicks in them in various stages of "progressive development." We were not disposed to be fastidious—we had long looked upon this as mere sentiment. Why not an egg in this state as well as a "new-laid" egg?—one was a part of the other, and, if only sound, why not eat it? So they were eaten.

After our luncheon—an uncommon event with us—we renewed our task, which was completed in just sufficient time to enable us to get to camp before sundown. We had all had enough of it for that day, at least; and I came to the conclusion that much of such work would beat us, as was proved by the final result, to follow a coast line road.

On the 1st October the descent in the second scrub was tackled. The plan adopted through the first one could not be carried out through the second. The work had to be performed in two relays—half at each passage. A man could only lead and drive two horses at a time, either pack or saddle, just as

the one or the other was good at following. He had to pick his way first, trusting to his horse doing the same. A false step on the part of either would have been dangerous, and in this way, after great anxiety and labour, the first batch were got down. One poor horse fell, but the good "lawyers" and scrub would not allow him to break his back by falling into the ravine, so he was urged to get up and move on. These I led to the plain below, and left in charge of Mr. Taylor; but, before starting with them, I sent back Mr. Nation and Mr. Stewart to pack up the remainder of the horses and bring them to the mouth of the scrub, and there await my return. The return to the camp was painfully laborious; in places it looked more like going up the shrouds of a ship than travelling on land; a man had often to avail himself of the neighbourly aid of a sapling or a vine to pull himself up with, and it was impossible not to reflect how it had been passed over by the horses, and how would it be got over by the next batch. It is wonderful what horses will do when properly put to their work. This I have had many opportunities of proving on this journey. The second batch was also successfully got down, when we moved to camp, distant two miles, where there was a beautiful little running stream, and good grass on the plain for the horses. On looking back at the mountain which we had descended, we felt thankful at having done with it so successfully, hoping that it might be the first and last of the sort.

On the 2nd October started away on a south-east course, when in  $3\frac{1}{2}$  miles I reached the seabeach in Weary Bay. There I met with the Bloomfield River, which drove me inland to find a crossing. This brought me to another scrub, which had to be cut through for a quarter of a mile. The road was down a steep ravine, with jumps from three to four feet down over smooth faces of rocks. The first four horses were down one upon another; the remainder were unpacked and driven down with only their pack-saddles on. Now came the labour of the men: all that the horses had hitherto carried had now to be carried down by the men over a fearful ravine, which afforded precarious footing. The labour was severe, and it took the party till nearly sundown to accomplish the task. The horses that fell were dreadfully lacerated.

On the 4th October I again cut the Bloomfield, which is a fine running river 20 yards in width, and has a fall of 100 feet just above my camp. To reach it I had to clear my way through two more cuttings of scrubs, to find myself more completely hemmed in than ever. The opposite bank of the river presented precipitous faces of hills hundreds of feet in height. On the side of the camp broken ridges of equal height kept us in. There was but one outlet, and it was doubtful whether the horses could succeed in climbing up its face; but the attempt must be made. To remain here was impossible, and to return almost equally so. The attempt was made: two or three of the strongest horses went first—they were just able to manage it. I saw there was no chance for the weaker ones, so I ordered them to be relieved of half their loads, with which they barely succeeded in climbing the face of the hill. Poor "Billy" fell for the second time, and again the friendly interposing of trees prevented him from coming to his end. Every horse had to be led up: we then had to carry up what the horses had left, and it is hard to say which was the more laborious work—to carry up or to carry down; the work was most exhausting. My object now was to clear myself of the scrubs and mountains, and to do this I had to abandon my course—now impracticable—and follow out leading ridges that would somewhere or another bring me back to my intended course.

On the 9th October the Bloomfield was again cut—still a strong and beautiful stream, hemmed in by mountains. The intervening country between this and the last camp was of the roughest and worst description: scrubs had to be cut through, the steep faces of ridges had to be ascended, only to be descended,

owing to the impassable nature of the country along them ; men had to dismount and drive the horses before them : these it was difficult to keep on the intended track—the leading ones would go along the fearful sidelongings, and drag the others after them. The men found it impossible to overtake the strong horses : every step had to be carefully taken, otherwise it is hard to say what might have been the consequences to them ; all the shoutings and the blessings failed in arresting them, and not until great labour and exertion (without any patience) had been expended, were they brought up and again put in the way they ought to walk. In some places the ridges just afforded passage along its crown for one horse at a time : one peak after another was ascended as being the last one, when another came in view, only to show still another ; but as all things come to an end, so peaks must come to an end, and I at last, with great labour, found myself on the crowning one. I beg to refer to my diary for the particulars of the last day or two's travelling.

On the 10th October I crossed the Bloomfield, and pursued a general course of south-east, along similar ridges ; but now the scrubs again made their appearance : these led to the last camp in a southerly direction, and the turning-point of the expedition. While traversing gullies and scrubs in search of a road, I came across the largest snake I ever saw : I shot it, and, when dead, the reptile measured upwards of 16 feet in length, and was of the boa tribe. My blackboy was in ecstasies, as well as some of the other members of my party, if I may judge from the altercation which it led to between the Doctor and myself.

On the 12th October, I reached my sixty-fourth camp, and the last one of all hopes to go in a southerly direction. Shortly after arriving at it, a lot of natives made their appearance ; they were friendly, and passed the day with us. I gave them handkerchiefs and fish-hooks, and in return they robbed my camp during the night ; they had been seen by the Doctor during his watch, but the deed had been committed when the alarm was given, upon which they cleared out. Two attempts were made by me to try and force a passage out of my present position, but I regret to say without avail ; no reliance, I found, could be placed on any information from the natives, want of knowledge of the language would alone cause this to mislead travellers. I must examine for myself, for the last time, and with this view I started off, accompanied by Dr. Tate and Jerry ; we crossed and recrossed the river several times, penetrated several patches of scrubs and long grass, when at the end of 9 miles we ascended a high hill, densely covered with the former, from which one look was sufficient. Here the last lingering hopes vanished, depression took their place. Had the expedition borne privations and toils for this ? Was it to turn its back on its course with such a reward ? The answer was imperative, and lay before it.

From this hill I could see the sea to the east, at a distance of 8 or 9 miles, with a black and impenetrable patch between us, stretching over low and very broken country ; this black patch was scrub. To the south, the Dividing Range reared its front, covered with the same vegetation and forbidding approach ; the range hung over the sea as far as the eye could see south, all equally clothed in scrub. Cape Tribulation rose with its clouded head to the north ; to look at it was sufficient to create the feeling indicated by its name, it revelled in scrub above, below, and around it for miles ; the eye rested on hills and scrub everywhere, there was not the ghost of a chance of finding a track to thread these mazes, and to endeavour to penetrate them would have been madness. There was no course left open for me but to turn my back on this dismal scene, and retrace my steps to camp. I communicated to my fellow-travellers the results of the morning's work ; how nature had thrown insuperable difficulties across the path of our hopes and wishes ; that if we had succeeded in baffling her hitherto, she had repaid herself a hundredfold by her

last barrier, at which we could gaze but could not overcome, situated as we were for provisions; and that, therefore, the only course for us to pursue, was to beat a retreat for our own salvation.

And now I had to review my position for a retreat. All along this had been a matter of serious thought and consideration with me, and I lost no opportunity of impressing it on my party. But for this, on my part, and a careful expenditure of my resources, how should I have been situated for a retreat movement? If I had allowed rations to be used in the quantities that some desired, I should long ago have seen the last of them, but I was told that I should have brought more. My answer was, that it was evident that I had brought enough to keep all in health and strength; none were failing or failing. I was told that Australian exploration in these days was reduced to the simplicity of "railway travelling." I challenged the proof of this being the case in one single instance. Could anything so utterly absurd be advanced by any man with ordinary common sense? I fancy I see the curl of derision and contempt upon the lips of my old friends, explorers, and bushmen, upon learning that any idea so fallacious could enter into the head of any man. For what are the objects and qualifications of exploration? First, the discovery of country; and, secondly, the doing it upon as small means as is compatible with health and strength. What real bushman ever looks forward to this as a cambric handkerchief existence, with an agreeable morning's ride, and high feeding? Should not men, offering themselves for such work, examine themselves, and ascertain whether they can face the privations and hardships accompanying such work, and whether they can place a check upon an inordinate desire to be always eating? My opinion is that they should do so, if only for their own sakes.

And, had it not been for my stringent measures in regard to rations and victuals (forced upon me), I should not now have been in a position to carry my party through the remainder of the journey, which it would take four weeks to bring to an end. I beg to refer to my diary for many other particulars connected with this retreat movement. I now turned to and shod all my horses that had dropped their shoes in coming over the dreadful slate ridges, as well as those that were tender-footed. I had my fears for two or three that had given in on several occasions; but I was in hopes of still bringing them on, if I could once get them safely out of this mountainous country. All the packs were overhauled, and everything not absolutely required was discarded, but this did not amount to much. Every horse was now lightly loaded.

At the point where I left the Bloomfield, it was seen taking its course into the Main Range: the Endeavour was left taking its course into the scrubby mountains on the coast, a few miles from the sea, near Mount Thomas.

On the 16th October, on a general course of w.  $25^{\circ}$  n., I reached the first of the numerous branches of the Normanby, which was on the third day after leaving my 64 and turn-about camp. Most of the intervening country had been passed over by me before, and that which was new was equally painful and laborious to get over; but I was once more in an easy travelling country: its formation was still slate, showing a fair quantity of quartz over the surface. Surprised a camp of natives in the bed of a creek, all women and children. During the night the camp was again visited by the blacks; but a shot or two soon dispersed them.

On the 18th October I left what I may call the second branch of the Normanby: it ran through a wretched country of bare slate ridges. The descent into it was trying on the horses, and it was only by dint of hard urging that they could be induced to descend the face of the steep hill. The nature of the country to it was composed of slates and quartz: a remarkable range, high and rugged, was to the west of my course; I have named it Andrew's Range, having been solicited by the Doctor to do so, in remembrance of a friend of his lost in the *Maria*, on her attempt to reach New Guinea.

On the 19th October I reached the third branch of the Normanby, which I did over basaltic country of the finest description. This was the first change of formation which I had met with since coming into the Endeavour country; and all the way along the coast, where it had been entirely slate, this stream divides the two formations—the slates keeping the southern, while the basalt keeps the northern, side. I was under the impression, when this stream was first met with, that I was on the Kennedy; but subsequent observation convinced me of my error. I followed it for two days, although not quite in my course. I had now got into sandstone formation, and very rough and formidable the hills looked for a passage across them; experienced heavy rain, which checked my travelling for one day, but I was rather glad of it than otherwise, as my horses had fine feed, and there was the chance of its giving me water on my road.

On the 24th October I cut the fourth and fifth branches of the Normanby, at a distance of  $7\frac{1}{2}$  miles apart. It was upon coming upon this last running branch that I was convinced of my previous error, from the fact of remarking that the Normanby when parted with was a strong running stream, which must have derived its supply from some ranges, and also that this was the first running stream going in that direction which I had met with; from this I inferred it to be the water which I had last parted with as the Normanby.

On the 26th October I reached the head-waters of the Kennedy. I also had some doubts here; but these I soon solved by following down the river, which I found going north, and in some instances to the east of that point, therefore it could be no other than the Kennedy. The passage across from the Normanby was most laborious and painful work on all: the pass among these sandstone ranges was up a steep ravine, blocked up with immense boulders and rocks; the sandstone cliffs were towering above us to a height of 300 feet on either side, making the scene a very grand and impressive one; the horses were driven in mobs, as through the scrubs, and until the task was completed I had my doubts as to its success; the descent was equally painful and severe on the poor animals.

This sandstone range continues its course to Jane's Tableland, at the south end of Princess Charlotte's Bay. I crossed it on my route to the Endeavour from the Normanby, and I believe it to be about  $5\frac{1}{2}$  miles wide along its whole course.

On the 28th October I reached the Palmer; the passage to it over the main range was very easy, being up a fine valley at first, bounded on the east side by a slate range, and on the west by a sandstone tableland; it had a small patch of good soil showing limestone among it, and a fine creek along its whole length. The valley then contracted to little more than a pass for one horse, which brought us up gradually and easily to the summit of the dividing range between eastern and western waters. So here we were once more amongst old friends—we had the Palmer at our feet with all its familiar landmarks, while in the distance our lofty friend, Mount Mulgrave, stood out boldly and conspicuously, and, if not actually bidding us welcome, at any rate pointing out to us our road home, after so many months of varied feelings of hopes and disappointments. All further interest, so far as exploring is concerned, may be said to be at an end; we are treading upon known ground, and, where not absolutely upon our own tracks, these are only deviated from to cut off bends and shorten the journey as much as possible. The character of the country has not been found to differ from that on which the outward track was made. Every day brings our troubles to an end.

On the 31st October I arrived on the Mitchell. My return track kept to the eastward of Mount Mulgrave; a bold, high, and remarkable range stretches across from the bank of the Palmer to that of the Mitchell—I have named it

"Thompson's Range," after the Minister for Lands: its direction is north and south, and is of slate formation, whereas the country over which I returned is mica-schist with quartz on the surface.

On the 1st November I reached the Walsh. This river was not running, although the Palmer, and the Mitchell had larger supplies than when passed over by me on the outward trip, owing, no doubt, to the late rains. The same fine country was passed over between the Mitchell and the Walsh, to which I alluded on my outward route; dropped my third horse here—he could not accomplish the long stage. Followed up the Walsh for three days without anything more interesting being seen than has already been described.

On the 6th November I reached the Tate. The first part of the journey was over sandstone hills and ridges, the latter in places very scrubby. Then we passed over open ridges, which had been burnt, and which I have always found best for horses travelling. On the first day the remains of some horrible water was found in a hole, which none of the horses would taste, and that night the expedition camped without water for the first time, but it was found the next morning at an early hour; the latter part of the road was over a slate formation. I intended following the Tate so long as it kept my course, but in this it was not intended that I should succeed, as the river bore away east, when I abandoned it.

On the 9th November I reached the Lynd, and on the evening of the same day I made my camp on Fossilbrook Creek. On leaving the Tate I followed one of its tributaries on a south course. The country passed through was of greenstone formation with quartz veins peeping out in all directions; it is the most likely looking country for gold that I have passed over. Of its extent I know nothing, but I think it very likely that it will join the slate formation met with by me on all these western rivers—all of which I believe to be well worthy of being carefully prospected. I have no doubt myself that in this direction there is a wide field for research. The above description of country extended as far as two hills on my course; these I have named Mount Macdevitt, after the member for the Kennedy, and the other Mount St. George, after the Commissioner at the Etheridge. After leaving these hills I passed through some abominably rough granite ridges, which afterwards opened up into splendid travelling over burnt and sandy country. My last fright for the horses was received here, but, fortunately, it was only alarm: no doubt that one of the mares was a little ill, but, when I heard it said, "Good God, they are all poisoned," it was quite enough to startle me and hasten my departure; but one thing was evident, that the exclainer did not know a sick horse from a horse that had lain down for rest, and had given a grunt of satisfaction when it had done so.

On the 12th November I arrived at Junction Creek all safe and well, where the expedition closed its labours.

In conclusion, I would beg to state, that the expedition has travelled over 1500 miles of country since its first starting out; that it has passed through no ordinary dangers and difficulties, and if the results have not been more favourable to the interests and advancement of this country, it has not been owing to any want of energy or perseverance on the part of the expedition to secure them. The country was a "*terra incognita*" before, but the labours of the expedition have unfolded its character, of which nothing was known hitherto; and if these have not been such as could have been desired, I can only say, that that which did not exist could not be found. I, however, feel assured that the Government will give me the credit of having faithfully and zealously carried out the great work entrusted to me, which I did to the utmost of my ability and the best of my powers.

Wm. HANN.



PROCEEDINGS  
OF  
THE ROYAL GEOGRAPHICAL SOCIETY.

[ISSUED MARCH 28TH, 1874.]

SESSION 1873-74.

*Fourth Meeting, 12th January, 1874.*

MAJOR-GENERAL SIR HENRY C. RAWLINSON, K.C.B., VICE-PRESIDENT, in the Chair.

ELECTIONS.—*Dr. Geo. Anderson; W. J. Beach, Esq.; Henry D. Bell, Esq.; Isaac H. Burch, Esq.; Dr. N. Bushell; Major Jno. B. Champain, R.E.; Captain G. N. Channer (Bengal Staff Corps); A. W. M. Clark-Kennedy (Coldstream Guards); W. W. Cooper, Esq.; C. L. B. Cumming, Esq.; C. T. Dent, Esq.; Thos. Devas, Esq.; Wm. Devereux, R.N.; A. W. Edgell, Esq.; Walter Farquhar, Esq.; Thos. C. Greenfield, Esq.; Barrie Goldsmid, Esq.; F. A. Lloyd, Esq.; D. Macliver, Esq.; Major-General W. M. Scott MacMurdo, C.B.; G. P. Moodie, Esq.; Elias de Pass, Esq.; M. Wilks Richards, Esq.; Wm. Sparrow, Esq.; Gerard Thomas, M.A.; Wm. J. Valentine, Esq.; Edwin Ward, Esq.; Rev. S. J. Whitmee.*

PRESENTATIONS.—*Dr. Wm. Mackenzie; Dr. N. Bushell; Commander Jno. Jones, R.N.; G. A. Anstey, Esq.; W. L. Lawrence, Esq.; I. H. Burch, Esq.; Theodore Carter, Esq.; Gilbert Wood, Esq.*

ACCESSIONS TO THE LIBRARY FROM DECEMBER 8TH, 1873, TO JANUARY 12TH, 1874.—‘Illustrations of Venezuela.’ (A Catalogue.) By James M. Spence. Manchester, 1873. Donor the author. ‘Memoir of the Founding and Progress of the United States Naval Observatory.’ By Admiral B. F. Sands, U.S.N. Washington, 1873. ‘Ninth Census: Statistics of the Wealth and Industry of the United States.’ By F. A. Walker. Washington, 1872. Donors the U.S. Senate. ‘The Ocean: its Tides and Currents and their Causes.’ By W. Leighton Jordan. 1873. Donor the author. ‘Das Areal der Hoch- und Tieflandschaften Europas.’ Von G. A. von Klöden. Berlin, 1873.

By Purchase. 'Statistique de l'Égypte, 1873.' Le Caire. Donor Ministre de l'Intérieur, Egypt. 'That Goodly Mountain and Lebanon.' By Thos. Jenner. 1873. Donor the author. 'The Treasury of Languages.' 1873. Donor, — Hall, Esq. 'The Ashantee Difficulty.' By J. Irvine. Liverpool, 1873. Donor the author. 'A Paper on Assam.' Printed by order of the Secretary of State for India. By J. McCosh, M.D. 1873. Donor the author. 'An Appeal on behalf of the Ngalirankawa Tribe.' By T. C. Williams. New Zealand, 1873. Donor the author. 'Anatomy of the King Crab.' By Richard Owen, C.B. 1873. Donor the author. 'Some Revelations in Irish History.' Edited by Saxe Bannister. 1870. Donor the editor. 'Lendas da India.' Por Gaspar Correa. Lisboa, 1859-1864. 'Collecção de Monumentos Ineditos: Conquistas dos Portuguezes em Africa, Asia e America.' R. J. de Lima Felner. Vols. I. and II. (Asia). Lisboa, 1858. 'Historia dos Establecimentos Scientificos, etc., de Portugal.' Por J. S. Ribeiro. 3 vols. 'Flora Cochinchinensis, etc.' J. de Loureiro. Ulyssipone, 1790. 2 vols. 4to. 'Ensaio Economico sobre o Commercio de Portugal e suas Colonias.' A. J. J. da Cunha de Azeredo Coutinho. Lisboa, 1828. Donor the Portuguese Government. 'Lectures on the Geography of Greece.' By the Rev. H. F. Tozer. 1873. Donor the author.

ACCESSIONS TO THE MAP-ROOM SINCE THE LAST MEETING OF DECEMBER 8TH, 1873.—MS. Map of a Route from Suakin to Kasala. By the late Captain L. Rokeby, R.M.; through F. Parry, Esq., F.R.G.S., for telegraph line. On 8 sheets. MS. Map of Canton and its Environs. By Captain L. Rokeby. Sketch-Map of the Chinese Province of Kuang-tung. By W. S. F. Mayers, Esq. The above presented by F. Parry, Esq., F.R.G.S. 5 Sheets (in duplicate) of the Topographical Map of Sweden. Presented by the Swedish Government. Map of the Ashantee Country and the Gold Coast. Presented by the War Office. 4 Maps from Petermann's 'Mittheilungen,' viz.: 1. Cruise of the *Challenger* in the North Atlantic; 2. Ashantee Country and Gold Coast; 3. Map of Central Europe, showing population; 4. Part of Texas. MS. Sketch-Map of the entrances to the Lufigi River, East Africa. Presented by Captain W. J. L. Wharton, H.M.S. *Shearwater*. 825 Sheets of the Ordnance Survey, on various scales. Presented by the First Commissioner of Works. Through Sir H. James, Director.

The CHAIRMAN apologised for the absence of the President, Sir Bartle Frere, who was detained in Scotland, where he had been lecturing on the subject of Dr. Livingstone and his travels, and had re-awakened, or, at any rate, given expression to, that feeling of interest in the great traveller's move-

ments which had always been so prominently felt in Scotland. He had no doubt the result of Sir Bartle Frere's visit would be the furnishing of sufficient funds to meet any of the expenses of the Relief expeditions. With regard to Livingstone himself, the stories that had reached England about his arrival on the West Coast of Africa had proved entirely false. Dr. Bastian, the late President of the Berlin Geographical Society, who had recently visited that coast, had proceeded up the Congo to Embomma, and satisfied himself that the whole account was a fabrication. It might be taken for granted that the first intimation of Livingstone's being on the West Coast would reach England through the Society's emissary, Lieut. Grandy, who, by the last accounts, had passed up from San Salvador to the Congo, which he hoped to strike above the Rapids. He had sincere pleasure in being able to make an announcement which would be most gratifying to the meeting. Mr. Young, the liberal friend of Livingstone, who had already contributed 2000*l.* towards the expenses of the West Coast Expedition, had now informed the Council that he was prepared to take on himself all further outlay in regard to that expedition. Nothing could exceed the handsomeness of such an offer. The Council had unanimously passed a vote of thanks to Mr. Young, but he (Sir Henry) thought it would be still more gratifying to that gentleman if the present meeting would supplement that vote.

This having been done by the cordial expression of the feelings of the meeting, Sir Henry continued :—

With regard to the East Coast Expedition, Dr. Kirk, who was on his way home to England, had recently reported that it had reached Unyanyembe, and was about to proceed onwards with every expectation of passing through the intermediate country and reaching Ujiji in safety. At Ujiji they hoped to get some information about Livingstone's movements, that they might direct their steps either to the south of Tanganyika or across it to the country of Manyuema, so as to intercept him and furnish him with the requisite supplies at the earliest possible moment. They were not likely to obtain any certain intelligence from Livingstone until Lieut. Cameron, or some of his party, fell in with him. Nothing direct had been heard from him since he left Unyanyembe in August 1872 for the south of the lake; but he had probably proceeded from that point to the source of the Lualaba, from whence he would ascend the river towards the great equatorial lake, and somewhere in Manyuema, or in the vicinity of that lake, he ought to be first heard of either by Lieut. Cameron or Lieut. Grandy's expedition.

Sir HENRY then introduced the first communication to be read, by saying that Mr. Douglas Forsyth had been deputed by the Government of India to conduct a mission to the Court of the Atalik-Ghazi, the ruler of Kashgar and Yarkund. His journey hitherto had been very successful, but the results which were expected in the future would in all probability far exceed in importance those which had already been achieved. The letter was addressed to Sir Bartle Frere, and contained an account of his journey as far as the frontier station of Shahidulla. No direct information had been obtained of his proceedings beyond that point until this day, when his brother, Mr. W. Forsyth, Q.C., received a letter from Yarkund, containing some very interesting details. That letter would also be read to the meeting.

The following letter was read by the Secretary, Mr. R. H. Major :—

" DEAR SIR BARTLE FRERE, " Shahidulla, 18th October, 1873.

" In the Annual Address of the President of the Royal Geographical Society I observe that reports of the progress of the Mission now entering

Yarkund are looked for by the Society, and I have great pleasure in responding to their wishes. The best way of supplying information appears to be in the form of extracts from a Diary which contains all the careful observations made by Captain Chapman, R.A., Dr. Bellew, and Nani Singh, the chief of Major Montgomerie's pundits. This Diary, which has been kept by Captain Chapman, refers at present only to the route taken by me from Leh to Shahidulla. Captain Trotter, R.E., took the Changchemno route from Leh, and is at the present moment engaged in surveying some peaks not far from this, and prefers waiting till his arrival at Yarkund, before compiling a paper from his notes for the Royal Geographical Society.

"The whole question of routes to Yarkund is still under consideration, and, until I have completed my enquiries, it would be unwise to form a decided opinion: but, as I understand that English traders are already beginning to think of trying this market, it would be as well for me to give a few general hints.

"In one of the Society's Reports of Proceedings I see it stated that Mr. Shaw has discovered a way of avoiding the Karakorum. I am not aware what way is there alluded to, but lest English traders should receive the impression that all the difficulties of the Karakorum can be avoided by taking another line over the Himalayas, I will give a short account of the only routes at present known to be practicable.

"Commencing from the east, one line goes from Leh over the Chang La Pass, 18,368 feet, then along a valley to the Panggong Lake (13,900 feet) over the Masimik Pass, 18,540 feet high, into the Changchemno Valley, which it leaves by a pass 18,800 feet high, and enters on the Lingzi Thang and Thaldat Plains, which range from 17,700 to 15,500 feet, for five marches. The route then strikes the Karakash River, descending which the traveller reaches Shahidulla in 26 marches from Leh. Along the route grass and fuel are scarce for 10 marches, and absolutely wanting for 8 marches. Water, too, is not procurable, except of the filthiest description, and most scantily on the high plains first mentioned. This route was but little known to Europeans till M. Schlagintweit crossed it in 1858-59. Mr. Johnson of the G. T. Survey has the credit of first thoroughly exploring and mapping it, and in 1868 Dr. Cayley travelled over it as far as the Karakash to ascertain its practicability as a trade-route. In consequence of his enquiries the Yarkund envoy, who was then returning from Cashmere, was induced to take that route, and Messrs. Shaw and Hayward followed in his wake; Mr. Hayward making at the time a really important discovery, that the head-waters of the Karakash took their departure from the Karakorum Range, and not in the direction supposed by Mr. Johnson. Mr. Hayward made another discovery on his return to India from Yarkund, which led us to the second route, which I shall presently describe, after disposing of the first route. For camels this route might be used as it was in 1870, by one Gool Morad, a Yarkundee trader, who brought 15 camel-loads of merchandise to Ladak with perfect safety; but mules or horses would suffer fearfully from the want of water and fodder.

"The second, or middle route, leaves the Changchemno Valley by a north-western pass, and crossing the Lingzi Thang Plain at its head, where it is only a few miles wide, enters the upper Karakash Valley, and, following that stream for about 70 miles, ascends a side valley across a very easy pass to the Karatagh Plain, and joins the Karakorum route at Aktagh. The merit of discovering this route belongs entirely and solely to Mr. Hayward, and he thought so highly of it that he strongly urged me to take it on my way to Yarkund in 1870. As, however, the information we then possessed was not sufficiently complete, Dr. Cayley undertook to make a thorough exploration, and he left my camp at the Changchemno Valley, and followed the Karakash

River along its course to Shahidulla; then returning by Karatagh he sent us a very carefully drawn sketch-map of the route by the upper Karakash to the Changchemno. By the aid of this map, and by his active assistance in sending out supplies along this line, I was able to bring back my camp in comparative comfort. Mr. Shaw accompanied me as far as the Lingzi Thang, and then branched off to discover, if possible, a shorter line. The result of his exploration has been laid before your Society, and, as he himself reports, he was not successful in opening out a better route.

" This second, or middle route, is 2 marches shorter than the first one, and 3 marches longer than the old Karakorum route. The pass leading out of the Changchemno is somewhat steep, and for one march on the other side the road runs along a ravine filled with sharp stones, which are most trying to horses, and would, I fear, be fatal to camels. As Captain Trotter has very carefully surveyed this route I will not anticipate his report, but, as it may be brought into general use, I am anxious that the credit of its discovery should be attributed to the proper persons. Dr. Cayley is too modest to put forward his own claims, but I think that he deserves much more credit than he has yet received for his exertions in the cause of science and commerce. In the present generation M. Schlagintweit was the first European to penetrate Eastern Turkestan, but he fell a sacrifice to his zeal, and the result of his explorations was lost to the world. Messrs. Shaw and Hayward visited Turkistan at a more favourable time, and to the former we are specially indebted for the tact and wisdom with which he conciliated the present ruler of the country, and the favourable impression he gave of the English character. Too much praise cannot, I think, be awarded to both these intrepid travellers for their pluck and perseverance; but I hope that equal praise may be given by your Society to Dr. Cayley for his successful explorations.

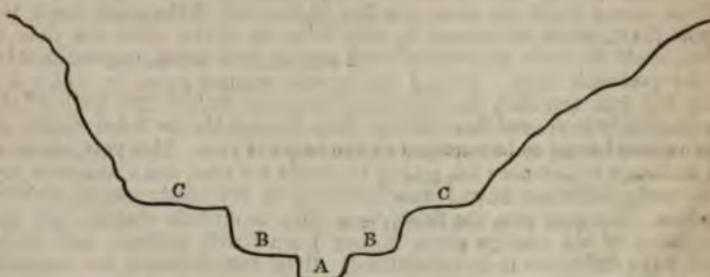
" I now offer some remarks on the much abused Karakorum route, regarding which I, in common with others, had fallen into error. In 1870, when Mirza Shadée, the returning envoy, accompanied me by the eastern route, he stoutly maintained that the Karakorum line was far easier; and I now find that he was not so very far wrong. The fact is that, *per se*, the Karakorum Pass is the easiest of any between Leh and Yarkund, the real difficulty lying on the passes which, by the summer route, have to be crossed between it and Leh, and which are avoided by the winter route.

" Looking at the question as one of gradient, and not considering the height, the ascent and descent of the Karakorum Pass are remarkably easy, and, as for the height, the passes leading out of the Changchemno Valley to either the first or second route are about 500 feet higher, and if the route down the Shyok River, which at present is only taken in winter when the river is frozen, could be made practicable for all seasons, this would, unquestionably, be the preferable route. Taking the present summer route, by which my camp has just travelled, the Kurdoong Pass, immediately after leaving Leh, is exceedingly steep, and has hitherto been impassable for laden horses, all merchandise having to be conveyed on the backs of yaks. This year, however, the Maharaja of Cashmere has greatly improved the road, and I took over my whole party, including large horses belonging to my cavalry escort, without any loss. The next pass, the Sasser, is a more formidable obstacle, and the description of the glaciers given in our journal will, perhaps, sufficiently explain the difficulties to be encountered. Even here, however, the Maharaja has effected great improvements, and, as yaks are always available to transport merchandise from the Nubra to the Shyok Valley, I think that the horror with which this route has hitherto been viewed may hereafter subside. And there is this great advantage, that by the Karakorum line the traveller is far less exposed to encampments at great heights, and the distance between Chang Lung, the last habitation on the Ladak side, and Shahidulla, is only 11 days;

whereas the distance between Tanksé, the last village on the Changchemno route and Shahidulla, is 20 days.

" I do not wish to underrate the difficulties of the Karakorum route. At best, it is fearfully trying, and there is a ghastly spectacle all along the line of dead horses, and sometimes of human skeletons. Not that it is absolutely necessary for this waste of life to occur. Out of some 550 animals which accompanied the two divisions of my camp, the loss of life has not exceeded twelve horses from exhaustion. But, then, traders do not proceed on the same careful principles which guide an expedition of this kind. Supplies not being procurable for many marches, it is an object with a trader to get the largest amount of goods conveyed across as cheaply and as rapidly as possible. To do the thing properly, no horse or mule should carry more than two maunds (equal to 160 lbs.), and should the animal become at all galled or distressed he should be relieved at once, otherwise the exhaustion and cold will soon kill him. But a Yarkundee trader proceeds on the assumption that each horse can carry three maunds (equal to 240 lbs.), of merchandise. He begins by covering him with thick felt clothing, on which a heavy pad is placed; then on this comes the ordinary three-maund load, and perhaps he adds a few clothes of his own, a heavy tea-pot, cooking-pot, and not unfrequently I have seen him jump on the top 'to steady the whole.' Long marches are then taken, and scanty food is supplied. Can we wonder, then, if the unfortunate animal succumbs? There is a horribly cruel practice, too, of which these men are guilty. Ascending great heights, the poor animals often become almost suffocated from want of proper breath, when the traders have an idea that the remedy is to enlarge the passage of air through the nostrils, and this they effect in a barbarous fashion. Throwing the animal down they cut a hole in the cartilage of the nose, to which they fasten some hairs of the tail, then letting the head go, and giving the animal a sharp cut with a whip, it jumps up, and the whole cartilage is torn away by the tail!

" To turn to a pleasanter subject, the Karakorum route offers to any one interested in the subject ample opportunity for forming theories on the action of glaciers. When travelling to Yarkund in 1870, I was much struck with the appearance of the Changchemno Valley. Evidently it must at some period or other have been a wide lake, and yet, so far as one could see, there was no point of contraction, where the mountain sides, closing together, could have confined the waters above. I give, from recollection, a rough sketch of the section of the valley.



" A represents the present course of the river; B and C are the beds of former fluvial action of some kind. From the appearance of an ice-bed I then saw in the Karakash, and from the absence of any dam to explain the stoppage of the waters so as to cause a lake, I had conceived the idea that O C must have been at one time an enormous ice-bed, which, melting away, had formed the

second bed, B B, and finally had melted away into the river-bed A. But Dr. Stoliczka, the eminent geologist, whom I rejoice to have as one of my companions, has pointed out a great error in the idea, and one which I find Professor Tyndall, in his valuable work, 'Forms of Water,' also disposes of, viz., that the action of a glacier is not smooth and equal in all its parts, and the surface of C C would not be so smooth as it is, nor would the sides descending to B B be so straight, had there been glacial action at work. I have now been led by further observation to a different explanation.

" As we travelled up the valley of the Nubra River we observed, on the sides of the very wide valley, marks, hundreds of feet high, on the mountains, of water, as if the river had at one time flowed so high. The valley is very broad, and there was no appearance of the mountain sides ever having approached near enough to each other to form a lake.

" When we crossed the Sasser, and came to the glaciers mentioned in the Diary of 9th Oct., I think we found the true explanation of these ancient lakes. There we found an enormous glacier many miles long, which had slid down from peaks 26,000 feet high, and had crossed the valley at right angles, choking it up entirely. In the valley above we saw distinctly the high bed of the lake which had been formed. This glacier came down only about ten years ago, and there are plenty of eye-witnesses to the formation of the lake, and to the subsequent subsidence of the waters by the bursting through of the glacier. In course of time, perhaps 200 years hence, this glacier will have disappeared, and future travellers will then find a state of things similar to what I recollect seeing in the Changchemno or in the Nubra Valley.

" We remarked in the Nubra Valley the existence of numerous moraines, or rather the evidence of such shooting across the valley, and possibly each of these at some former time was a fallen glacier, which had stopped up the waters.

" Perhaps some future Tyndall may think it worth his while to visit these regions, and, if so, I can promise him a grander field of observation than any that can be presented in Europe, or at least in the Alps. The appearance of the Kurmadan glacier is extraordinary. A mass of icebergs, 150 to 200 feet high, appear to be joined together for miles; and, having passed this as a unique wonder, we journeyed on to find the same repeated on a larger scale and in great abundance. The view from Gepshan is truly sublime. Looking up a wide gorge to the north-west we saw three enormous glaciers stretching back for perhaps twenty miles, and ending in peaks 26,000 feet, and the highest 28,000 feet.

" I hope to have the pleasure of sending you further information from time to time.

" I am yours, very truly,

" T. DOUGLAS FORSYTH.

" Right Hon. Sir Bartle Frere, K.C.B., G.C.B.,  
" President of the Royal Geographical Society."

Extracts from a second letter, received only the previous day, were then read by W. FORSYTH, Esq., Q.C. —

" Yarkund, November 12th, 1873.

" After all the prophecies of evil to our expedition I am truly glad to be able to address a letter from this place, which we have reached in perfect safety, to all my party, and since we have entered the dominions of our host we have been treated with the utmost attention and politeness. In fact, our progress has been a perpetual feast, and we have been feted as if we were princes. At Karghalik, the first large town we reached, we found an entirely new set of

quarters built for us, and made most comfortable with Khatesa (like Turkey) carpets, chairs made according to their ideas of English fashion, and glorious fire-places which don't smoke. Here our reception by the Governor has been quite in keeping with our expectations, and the utmost freedom is allowed us. Yesterday we wandered about the bazaars—the first Englishmen who have ever done so. The bazaars and streets are just like those in Stamboul. There is an idea in some people's minds that the Yarkundees are savages whose luxuries are not equal to what would be considered necessities by an Indian coolie. I wish such people would visit the city and be convinced to the contrary. The restaurants and the cookery there would put to shame anything we saw in Stamboul. In the streets numbers of barrows are wheeled about, for all the world like a pieman's cart in London, on which very clean and excellent toasted patties, bread, cooked vegetables, &c., are sold, and confectionary is hawked about just as at home. Then in the matter of candles we find excellent ones, made to burn, and not to sell only, as we find our supply from India to turn out to be, and we are using them instead of our own. Some of our party have been out to-day shooting, and have come back with woodcock, snipe, and wild duck, and we have had some English-looking pheasants. So much for the comforts of the flesh. As regards the objects for which I have come, everything looks promising, and I have had a very friendly letter from the Atalik (or Ameer, as I suppose in future he will be called). We shall remain here probably for ten days or so, and then I expect to be summoned to Kashgar, to present the Queen's letter, and after transacting business there we shall, I hope, accompany the Ameer to Aksu. But on this point I can only express my hopes, for the King does not make known his wishes or his orders till it suits his Royal pleasure to do so. We had a very severe time crossing the last Pass. I dare say some account of it will find its way to England before this reaches you, so I will not repeat the account. We have experienced intense cold at times, and even now in Yarkund we find the thermometer go down to  $10^{\circ}$  Fahr., and are told that winter has not yet begun. But with fur coats, caps, and boots for outside work, and with good large wood fires in our rooms, we have nothing to complain of as yet. My Highland piper excites great attention and amusement. The Dadkhwah, when he saw him, thought he had forgotten to put on his breeches. The scientific members of my party are daily getting a mass of information, which will, I hope, afford satisfaction to the different societies at home. Of course I have plenty of bother at times, for it is difficult to keep 131 men in good humour and good order at the same time, when away from their own country and amid such cold. But, on the whole, everything goes smoothly, and I have seldom to exert my authority. I am singularly fortunate in my officers; one and all are most active and zealous."

Dr. LEITNER said he was glad to find that Mr. Forsyth had given due credit to Schlagintweit, who was the first European who crossed the frontier and visited Yarkand. He hoped that Mr. Forsyth would try to find some more records of Schlagintweit. He himself had recovered a map which was drawn up under Schlagintweit's directions by Mahammed Amin, his trusted companion. Of course that map was very much inferior to what might be expected from Mr. Forsyth and his party, but still those who gave their lives to explorations, and laid down the first rough sketch, should never be forgotten. When at Yarkand, Schlagintweit stayed at the house of the Yarkandi whom he (Dr. Leitner) brought to England in 1869, and from him they learned that there were banks in Yarkand, and that financial operations were carried on by means of paper, very much as in this country. The Yarkandis were evidently a people who would be quite ready to take advantage of an opening for trade. It was intended that Mr. Forsyth should return through Badakhshán. He

(Dr. Leitner) had always contended that the main road from India to Central Asia was by Chitral and Badakhshán, and he believed, if Mr. Forsyth returned that way, he would find that the portion of that route that branches off to Yasin and Ghilgit was so good that any traveller might go over it. He hoped that in passing along that road Mr. Forsyth's attention would be drawn to that extraordinary race the Siah Posh Kafirs, one of whom had accompanied him (Dr. Leitner) home to England. They were a race whom some supposed were descended from people left here by Alexander the Great, on his invasion of Northern India.

The CHAIRMAN observed that if Mr. Forsyth succeeded in reaching Aksu he would perform a feat superior to that of any traveller who had yet ventured into the wilds of Central Asia. The very old travellers, such as Rubruquis, went far to the north, while Marco Polo and Benedict Goes went far to the south. If Mr. Forsyth was able to visit Asku, and to fix its position, he would be entitled to the thanks of all geographers. The route which Mr. Forsyth proposed to take on his return to India, by the Chitral Valley, was undoubtedly the natural high-road between India and Tartary, if only the tribes would allow it to be followed. He must, however, raise his protest most determinately against the notion that the Siah Posh Kafirs had anything to do with Alexander. They were a good old race, and of course it was very interesting to get any details with regard to them, but no ethnologist of the present day believed that they had anything to do with the Greeks, or showed any trace of Greek civilization.

The Paper of the evening was the following, read by the author:—

*On the Geography and Resources of Paraguay.* By Prof. LEONE LEVI,  
F.R.G.S., F.S.A., F.S.S., of Lincoln's Inn, Barrister-at-Law, Doctor of  
Political Economy, Professor of Commercial Law, King's College,  
London, and Consul-General for Paraguay.

ALTHOUGH the Southern Continent of America, and especially the basin of La Plata, has been sufficiently explored, and its geography is well known, it is much to be regretted that but scanty information exists regarding the many States therein constituted, and more particularly respecting the limits and resources of the Republic of Paraguay. Its inland position, the revolutions and wars by which it has been agitated, the exclusive policy which its former rulers, Dr. Francia especially, for so many years maintained, and its almost dramatic history, have tended to restrict the amount of communication between the Republic and the outer world, and to retard considerably its economic progress. But a new leaf is about to be turned; the nation has learned, by sad experience, what it is to oppose those natural and economic laws which an allwise Providence has established for the welfare of man, of whatever race or clime, and I trust that a brighter future may be yet in store for a country which is universally described as fertile in resources, as she is interesting for her history and associations. It is indeed a good omen of happier days to come, that, by the authority of the

Government, its Minister Plenipotentiary, his Excellency Don Gregorio Benites, and myself, its Consul-General, have recently appointed a scientific Commission, consisting of Mr. Charles Twite, M.E., late Reporter to the Royal Commissioners of Mines, M. Balanza, late Commissioner of the French Government to Nova Caledonia and Egypt, and Mr. Keith Johnston, F.R.G.S., to proceed to Paraguay to examine and report as to the resources of the country. The publication of their reports will, I am sure, do much towards dispelling any ignorance respecting the condition of Paraguay, and I shall be glad, indeed, if the appointment of that Commission should prove the means of advancing geographical science. Meanwhile, as some time must elapse ere such reports can be obtained, may I be permitted to call the attention of the Society to several matters of importance relating to Paraguay, in which its judgment may be of the greatest value, though I cannot pretend to throw much light myself on the geography of Paraguay, having never yet crossed the Atlantic.

Much has been written respecting Paraguay and the Rio de la Plata. There is a standard work by Felix de Azara, who was sent as a commissioner by the Spanish Government to trace the boundaries of Spanish and Portuguese territory at the end of the last century (1781-1800), '*Descripcion é historia del Paraguay y del Rio de la Plata*', and a still older work in Spanish, by Guzman, the '*Historia Argentina del descubrimiento, poblacion, conquista de las Provincias del Rio de la Plata*'. There is a narrative, by Commodore Page, of the exploration of the tributaries of the River La Plata and adjacent countries, during the years 1853 to 1856, under the order of the United States Government; an excellent work by Colonel Du Graty, who resided twelve years in Paraguay; and a still fuller work by M. Alfred Demersay, who was charged with a scientific commission to South America, '*Histoire physique, économique et statistique du Paraguay*', besides other more general works, such as D'Orbigny's '*Homme Américain*'. Sir Woodbine Parish's '*Buenos Ayres before the Conquest*', and Hutchinson's '*The Parana and South America*'. Only recently honoured with being enrolled myself among the members of this distinguished Society, I am not indeed conversant of how far its rules admit of the introduction of any economic considerations side by side with the political and physical geography of a State, but I have often thought that geographical science does not consist only in a knowledge of the leading features of the earth's physiognomy, or configuration of every land or state, but in a full and perfect knowledge of its geographical position, and of the character of its soil, its animals, and its inhabitants. It may be

within the province of the ethnologist, botanist, or geologist, to find out the correlation and distinction of the different races, plants, minerals, or stratas, under different latitudes and climes, but it is clearly within the province of the geographer to tell us which of them dwells, or is to be found, in any specific locality, and what are its special characteristics.

Paraguay, being an inland state, is not so well situated as other countries in South America for communication with the outer world. Brazil, Uruguay, and the Argentine Republic have splendid seaports, but Paraguay, like Switzerland, has no outlet except by river communication, her very existence depending on the free navigation of the Parana and the Paraguay—splendid rivers, certainly, but unfortunately passing through other states ere they reach the ocean. Hence the interest of Paraguay in securing, by treaty, the freedom of river communication; but hence, too, her state of perfect isolation in time of war, when treaties are ignored or abrogated. What can be done to extend the means of communication between Paraguay and other states is a great problem. There is a small line of railway, at this moment, between Asuncion and Paraguary. Can we look forward to any great scheme of railway communication, such as a chain rivalling that from Chicago to San Francisco, in the United States—one stretching from Asuncion, in the very centre, to Rio Janeiro, Montevideo, and Buenos Ayres on the Atlantic, and across the Andes to Santiago on the Pacific? Could we make Paraguay the highway for all the mineral and agricultural resources of Bolivia and other northern states, what a source of improvement and wealth it would prove! The evil is, that railways do not well thrive where the population is slender and sparse. The strength of Paraguay, and, we may say, of almost all South American states, rests in their great rivers, which may be economised to any extent. The basin of La Plata is traversed by three leading sources of water—the Paraguay, the Parana, and the Uruguay, with their numerous tributaries. But, unfortunately, these rivers do not join except at the lower courses. Can direct communication, by canal or otherwise, be established between them in the higher streams? Is it possible to find, or to provide, any direct connection between the Paraguay and the Amazon by connecting their upper streams and by overcoming the obstacles interposed by the rapids? The Cuyaba, the Casca, the Diamantin, and the Oro, tributaries of the Paraguay, seem almost to join with the Tapajos, the Xinga, and the Tocantins, of the Amazon.\* Could a

\* M. Demersay says that the Itenes or Guaporé comes so near the River Jauri, affluent of the Paraguay, that between the basin of the Amazon and that of the

continuous navigation be established between the Amazon and the Paraguay by any means, we should have a current of water in the very centre of South America, traversing over 600,000 leagues, or twice as much as the whole length of Europe, which, according to Humboldt, has a superficial area of 302,000 leagues. These are questions of great moment, which I trust may ere long receive due consideration on the part of the Geographical Society.

The boundaries and extent of Paraguay are far from definite, her rights to certain portions of territory, especially the Chaco\* and the Missiones, or Candelaria, being still contested. It is not every state that has the inestimable advantage of having her natural boundaries so conspicuously defined as this sea-girt isle of Britain. Better than mountains or rivers, the Alps or the Rhine, the ocean and the Channel fairly separate England from her neighbours. It is not so with Paraguay, surrounded as she is by states, the boundaries of which, in many cases, are as undefined as her own. Let us see what is the nature of the disputes as regards the Grand Chaco. When the whole territory of La Plata formed one Spanish province, its limits being bounded by the Amazons in the north, Brazil in the east, Peru and Chili in the west, and Patagonia in the south, the territory under the name of Paraguay comprised four distinct provinces, viz. Paraguay proper, the Chaco or Tucuman, the Rio de la Plata, and the Parana. Subsequently, in 1680, the territory was divided into two provinces, viz. Paraguay and La Plata : the La Plata territory comprising Buenos Ayres, Entre Rio, Corriente, and Santa Fé, with all that forms at present the Oriental Republic of Uruguay ; and Paraguay possessing all the territory not specially designated for the Plata ; both provinces being independent of each other, yet dependent on the Vice-Royalty of Peru. When, in 1810, both La Plata and Paraguay declared their independence from Spain, Paraguay was in full possession of the Chaco ; and, from that time, nothing happened to interrupt the possession of that territory, except that during and since the late war between Brazil, the Argentine Republic, and Paraguay, the Chaco was, and remains, occupied by Argentine troops. In short, the title of Paraguay to the territory of the Chaco is founded on the fact that it belonged to her ever since the conquest ; that she established forts in it as a protection against the incursions of the Indians ; that she founded on the right of the

Plata there is only an isthmus which might be united by a canal of 5 kilometres dug in the marshes. There is a map extant by a Portuguese engineer, dated 1777, where mention is made of the possibility of forming such a canal.

\* The word "Chaco" seems to be derived from "Chichua," the name of the periodical llama hunts by the Incas.

Vermejo the town of Conception ; and that she requires the territory for her own protection. If we now take into account the well-acknowledged principle of international law, that the uninterrupted possession of a territory for a certain length of time by one state excludes the claim of every other, as well as the practice of nations in both hemispheres to acknowledge, in favour of any civilised nation making a settlement in an uncivilised country, a right of pre-emption of the contiguous territory from the native inhabitants, as against any other civilised nation, we might safely lay down that the claim of Paraguay to the Chaco is almost indefeasible.

As regards the territory of the Missiones, Paraguay claims possession of the same on the ground, that when Buenos Ayres was created into an independent province, she had only seventeen out of the thirty peoples which composed the Missiones ; that when dissensions occurred between the two provinces, arbitrators settled the respective jurisdiction of Paraguay and Buenos Ayres ; that when the territory of the Missiones was created into an independent Government, its rule was entrusted to the Governor of Paraguay ; and that by the treaty concluded in 1811, Paraguay was allowed to remain in the enjoyment of her own limits, and consequently with the government of the territory of the Missiones. The Argentine Republic will, no doubt, be able to present these questions from a different point of view, and to assert other reasons in their favour as regards both the Chaco and the Missiones, with which I am not conversant, but better far for both countries to relinquish their absolute rights, and by arbitration or otherwise to come to some satisfactory arrangement, than to leave the dispute to be settled by the terrible arbitrament of war. The boundary difficulty with Brazil is, I am glad to say, now ended by the treaty of 1872, by which the River Apa in the north was taken as a basis, instead of the River Blanco as heretofore, the line north and north-east now being the River Parana, the Salto Grande, the Serra de Maracaya, the Serra Amanbahy, and the River Apa. The boundary difficulty with the Argentine Republic still remains. On the 15th July, 1852, a treaty was signed at Asuncion, by which the River Parana was taken as the boundary of the two countries on the side of Corrientes, thus giving up to the Argentine the territory of Candelaria or the Missiones, but declaring the Grand Chaco, north of the Vermejo River, Paraguayan territory. But the Argentine Congress did not sanction the arrangement, and the question remains still in abeyance. Without pretending any absolute exactness in a matter on which so much doubt exists, the area of Paraguay proper may now be taken at about 70,000 English square miles. But if we add the Grand Chaco, north of the

Vermejo, some 170,000 square miles more,\* we have a total of 240,000 square miles, a territory larger than that of the United Kingdom.

Situated below the equator, between the 21st and 27th degree of latitude, Paraguay has necessarily a high temperature. Taking, as a basis, the observations made by the officers of the American steamer the *Water Witch*, and those made by M. Demersay, and placing them side by side with the temperature of England, as ascertained by Mr. Glaisher, and communicated to the Royal Society,† it would seem that whilst the average temperature in England for the year is 48° Fahr., in Paraguay it is 82°. But if we divide the year quarterly, the contrast is not always so great. The nearest approach between the temperature of the two countries occurred in the quarter from May to July, when the average in Paraguay was 77°, and in England 57°,‡ and the extremes occurred in the quarter from November to January, when in Paraguay the temperature averaged 89° Fahr., and in England 38°.

But excess of heat is not necessarily a cause of unhealthiness, unless accompanied by humidity. M. Demersay said, that he could less endure the temperature of Rio at 97°, than that of Paraguay at 110° or 120°, simply from the fact that, whilst in Paraguay the heat is dry, in Rio the heat is damp. The winds in Paraguay have, moreover, even more influence than the temperature. The north wind is certainly warm and enervating, but the south is cool and

\* The area of the Chaco territory, from the Rio or Bahia Negra to the Vermejo, is given at 16,537 Spanish square leagues.

† 'Philosophical Transactions of the Royal Society,' Part II. for 1850.

‡ AVERAGE TEMPERATURE, IN FAHRENHEIT.

	Paraguay.	England.
January ..	90	36
February ..	87	38
March ..	82	41
April ..	78	46
May ..	72	53
June ..	71	58
July ..	90	61
August ..	81	60
September ..	81	56
October ..	82	49
November ..	90	42
December ..	88	39
Average ..	82	48

The mean of all the monthly results from England from 1771 to 1849 was 48.3°, and down to 1870 49.6°. It should be noted, that whilst the observations in England extend over 100 years, the observations in Paraguay are only for single years.

refreshing. There appears to be no epidemic disease in Paraguay, except, indeed, a kind of fever which is incident to every marshy land; and if there be any complaint of unhealthiness now, I would imagine it to arise rather from the diminution of population, the cutting down of trees, and the destruction of cattle, than from any effect of the climate or temperature in their normal state.

What may be the population of Paraguay, at the present moment, is difficult to say. In 1857, when the last census was taken, Paraguay was divided into 25 departments, with a total population of 1,337,000, three-fourths of whom were centred in five departments, viz.: the Central, including Asuncion, Cordillera, Villa Rica, the Missiones, and Villa del Pilar. Since, then, however, Paraguay has had to endure a terrible war, in which the whole manhood of the population was engaged, and which has been exceptionally destructive of human lives. So that the number must be greatly lessened. But very soon the population is sure to recover itself, the natural increase of the population in Paraguay being at a much greater ratio than in any other country, even apart from immigration. The people of Paraguay are derived from three stocks, viz. the Indian of American origin or the Guaranee race, the white of European origin, and the negroes of African origin. But the greater number is an offshoot from the Spanish mixed with the Indian, the Guaranee Indian being a race extending from Guyana to Buenos Ayres, traversing Brazil, covering all Paraguay and reaching the Chiquitos. Whilst in Buenos Ayres the Spaniards disdained to ally themselves with the Indians, in Paraguay they readily took to themselves wives from the native Guaranee; and the result was a mixed race, possessing all the exterior advantages of the European and all the moral characteristics of the Indian, with also, of course, a fair portion of the evil propensities of them both. And it is from this fact that we can account for the continuance to this day of the Guaranee language among the people, a language almost monosyllabic, which bears close analogy to the Chinese.\* How came the Guaranees to be in the centre of South America? Whether they ever came originally from the old world, or whether they are indigenous to the soil, these are problems which I shall not attempt to solve. The Indians in the Chaco belong principally to three nations—the Nation Lengua, the Nation Toba, and the Machicuys—most of whom are very tall in stature, simple in habits, quiet in demeanour, with a language always guttural and nasal, and with scarcely any reli-

\* The Guaranee now spoken in Paraguay is a mixture of the original Guaranee and Spanish. In numerals, the numbers one to five have Guaranee names, the numbers six to ten have Spanish names.

gious belief. I have had now some experience of the Paraguayans. Ten years ago, four of them were students in my chambers of international law and political economy, and with many more I had the honour of being intimately associated, and I can say with perfect truth that I have found them one and all intelligent of mind, of rapid comprehension, and of persevering habits. Though naturally reserved in character, they are sweet in disposition ; and as for the ladies, they are handsome and graceful, lighter in complexion than the men, in manners most attractive.

If Paraguay has but a scanty population, she is certainly the paradise of animal life, every division of the animal kingdom having there its living representatives. The chattering monkeys, the audacious jaguar, the spiteful tiger, the ferocious lion, are all there. There are the vulture and the ostrich, the crocodile and the cameleon, the viper, the serpent, and many other reptiles, whose presence is often far too near human habitations to be borne with indifference, whilst the mosquitos are themselves a great nuisance. Many, too, are the domestic animals, which might be reared with extreme facility in Paraguay, though, alas ! human agents are but few for pastoral work. Cattle, horses, mules, and pigs will, however, some day again multiply, and furnish abundant food for the inhabitants as they did heretofore.

The geological condition and mineral resources of Paraguay have been more than once explored. The Cordillerita has been found to contain many pieces of oxydite iron, besides manganese and zinc. Some years ago, quicksilver mines were opened at San Miguel. And there is every reason to believe that, placed as she is in the centre of the massive continent of South America, and at the same distance from the beds of precious stones, gold and platinum, of Brazil, from the copper and silver mines of Chili and Peru, Paraguay may yet liberally reward any ardent explorer, who will not only ascertain the existence of valuable minerals, but strive, by the importation of capital and industry, to develop their resources. Mr. Robert Hunt, F.R.S., of the Jermyn Street Museum, to whom, as well as to Professor Ramsay,\* I am indebted for much assistance in drawing up the instructions to the Geologist of the Commission, called my attention to the fact, that since the Argentine Republic is developing into a mineral district of importance, and Brazil is rich in mineral resources, it becomes a matter of interest to deter-

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\* My acknowledgments are due to Dr. Hooker, F.R.S., the Director of the Royal Gardens, Kew, and to Mr. H. W. Bates, F.R.G.S., of the Royal Geographical Society, for their aid in preparing the instructions for the Botanist and the Geographer.

mine if there be any real continuation in Paraguay of the coal measure of the latter, or of the mineral heaving rocks of the former country. The reports of Mr. John Mier, F.R.S., and Mr. N. Plant, on the two coalfields of Brazil, published in the third volume of the 'Report of the Royal Commission on Coal,' deserve attention in connection with this question. Of marble, Paraguay has great abundance, and in choice varieties. The Paraguayan Government sent to this country a magnificent table of marble inlaid, representing upwards of seventy descriptions, most beautifully and artistically worked. And M. Du Graty tells us, that Paraguay possesses mineral substances for building, for the arts, and for industry in great abundance.

Of the richness of the flora of Paraguay, there is no manner of doubt. Flowers and fruit grow there spontaneously. Oranges, melons, peaches, and mandioca are growing wild in Paraguay. The sugar-cane grows luxuriantly. Cotton, superior to Egyptian, of excellent staple, may be had in any quantity. The *yerba maté*, a kind of tea, much in use in South America, is a source of great revenue, and an article of considerable commerce. Paraguayan tobacco is excellent; some kinds, especially the "Canela," being described as similar to the Havanna, and for which there might be an open market in London. The timber of Paraguay is known to be compact and heavy, exceedingly durable, almost indestructible. The *quebracho*, *legracho*, and *arundey*, are straight and free, rising, some fifty, some seventy feet from the ground. The *papercho* is described as superior to the best English oak. Of this *papercho* vessels are built, which live on the water for fifty years, and rafters are made, which are known to have supported roofs of houses for more than double that time. I would weary you were I to enter into detail of the flora of Paraguay. But if the land is so productive and nature so bountiful, why, it may be asked, is agriculture in so stationary and depressed a condition? A great obstacle, I presume, to agricultural progress must be the fact that a large and undefined portion of the land, some say more than half, belongs to the Government. But besides this, the extreme dryness of the temperature, and the multiplicity of insects, prove often very injurious, whilst the insecurity arising from political causes, the want of capital, and the difficulty of transport, have narrowed the field of agricultural labour, and greatly hindered agricultural improvement. What we require to know as respects agriculture, is not so much what produce is indigenous to the soil, as how to remove the obstacles which have hitherto hindered improvement, what is the capability of the soil for the introduction

of other tropical plants, and how far the continuity of crops from year to year may be safely relied upon.

Industry and commerce are not far advanced in Paraguay; not indeed from any incapacity for labour or inactive habits on the part of the natives, for Sir Woodbine Parish stated that the Indian labourer has been found capable of enduring an infinitely greater degree of bodily exertion than the most robust European, but mainly from political and social causes. Such policy as that of Francia, exclusive, arbitrary, meddling, and any instability and weakness of Government, must always have the worst possible influence on trade and finance. The principal articles of trade are tobacco-leaf, cigars, medicinal substances, as sarsaparilla and balm, dye-woods, wax, maté, indigo, gum, cotton, timber, and minerals, and they are of sufficient importance to raise the trade of the country to a considerable amount; but the people, unfortunately, do not make much of them, whilst the absence of seaports, which necessitates the use of Buenos Ayres and Montevideo, as intermediaries, takes from Paraguay any credit for even the little foreign trade which she does cultivate. Yes, Paraguay is indeed rich, but her riches are entirely undeveloped. Remember what England was about one hundred years ago, before coal and iron were scarcely known or appreciated. That source of enormous wealth was here then as now; but it was deemed of little or no account, simply because labour and capital had not yet been applied to mining operations. Was not Australia, only thirty years ago, little more than a convict settlement, though the existence of gold in that island was distinctly predicted by our late President, Sir Roderick Murchison? And so it is with Paraguay. It is as yet but a new country. It has a virgin soil. It has undiscovered and unappropriated riches, but it wants labour, it wants capital, it wants energy, it wants peace and quietness to encourage labourers, and to attract to itself the capital of the world. To an occasional visitor, who sees things as they are, the present condition of Paraguay must certainly be disappointing. But the settler who goes there with a little capital on hand, and with a *bond fide* intention to settle and to work, will soon see that the glowing accounts of the botanist and geologist were not fables concocted for a purpose, but sober matters of fact, upon which he may plan and work.

As is well known, the Government of Paraguay is Republican. When Paraguay ceased to be a dependency of Spain, the Government was entrusted to a Junta, of which Francia became the chief spirit. This, however, was soon replaced by the dictatorship of Francia alone, which lasted from 1816 to 1840. On his death, in

1840, the Government was again entrusted to three Consuls; but, after a little while, in 1844, Lopez became the sole President, and so remained till he died in the field of war, after a desperate struggle with Brazil, the Argentine Republic, and Uruguay. Even prior to the death of Lopez, a new Government was formed in Paraguay in 1869, consisting of Don Carlo Antonio Rivarola, Don Carlo Lorzaga, and Don José Bedoja. In 1870, Rivarola was constituted sole President of the Republic; and in 1871, Rivarola having resigned, Don Salvator Jovellanos became Vice-President, with the exercise of the executive power, and he continues in authority to the present moment. As we may well imagine, the finances of the state after a long and exhaustive war are greatly disordered. Some time must elapse before the people are able to provide a sufficient revenue, and meanwhile the expenditure must be comparatively large. But a few years' tranquillity will doubtless produce a great improvement, and I have no doubt that ere long we shall see trade and industry revive, and a stream of voluntary immigration set in from the south of Europe, Italians\* and Spaniards especially, which will cultivate the land, and help to develop the enormous resources of the country.

I regret that there is no postal treaty between Paraguay and the United Kingdom, and that there is no British representative at this moment in Asuncion. Britain never maintained a separate mission in Paraguay, Sir Charles Hotham having been sent thither on a special mission. From 1856 to 1860, Mr. Charles Henderson was British Consul at Asuncion; but since then no one has been appointed, and Britain has no representative whatever at the Republic of Paraguay, though she receives ministers from the same. Surely Her Majesty's Government will not lag behind in procuring the means for securing to the trade of England the most reliable information regarding a country in which many are deeply interested. A treaty of friendship, commerce, and navigation between Great Britain and Paraguay was signed at Asuncion, on the 4th March, 1853, by Sir Charles Hotham and General Lopez, by which, among other things, Paraguay conceded to the merchant flag of Her Britannic Majesty the free navigation of the River

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\* According to a Report by Mr. Macdonell, Her Majesty's Chargé d'Affaires at Buenos Ayres, in 1872, the Italians are the most prosperous of the immigrants in the states of La Plata. The number of Italians in the Argentine Republic was upwards of 120,000, and the amount of money the Italian population yearly remitted to Italy was very considerable. There is no reason why English emigrants should not succeed in Paraguay. Yet it should be remembered that Italians and Spaniards meet there a language more akin, if not identical, to their own, a temperature to which they are accustomed, a mode of living also similar, and the religion to which most of them adhere.

Paraguay as far as Asuncion, and on the right side of the Parana, from where it belongs to her, as far as the city of Encarnacion. But the treaty was for six years, only to be prolonged for one year longer in case neither party should notify its intention to put an end to it. Therefore the treaty is now expired.

Such is the condition of Paraguay. It is an extensive territory,—including the Chaco, even larger than Great Britain; in a southern latitude below the equator, with a warm temperature, yet healthy, full of resources both mineral and agricultural, with comparatively a very small population, with crippled industry, a small trade, and for the present a low state of finances, relieved certainly by the fact, that the State owns a large portion of land and property. What are the prospects of such a State? What is likely to be its policy? All we can say is, that should it be blessed in years to come with a steady and enlightened Government, with permanency of political institutions, with perfect civil and religious freedom, and with an honest and wise administration, the future of Paraguay is sure to be one of decided and continuous progress. But should internecine wars between her and other States continue to be, as heretofore, of frequent recurrence, or should bands of marauders or bandits still produce insurrections and confusion, there is nothing before Paraguay but misery and desolation. Let the past, with all its traces of destruction, suffice. Let a new era of peace and order be introduced. Let the spirit of patriotism nerve every Paraguayan to bring about a complete renovation—physical, moral, and political. Let the Government of Paraguay, which I believe perfectly honest in motive, and firm in purpose, strive with all its might to secure these blessings to the people, and we shall soon see capital and labour eager to explore the wide field which that country offers for work and investment. The task before the Paraguayan Government is an arduous one, and it will need to buckle on its armour to ensure success; but I will venture to hope that, as trustees of resources so great, and responsible for their administration to the whole civilised world, it will be its ambition, as it will surely be its interest, to more than fulfil all our expectations, and so to attract to itself the confidence and friendship of all civilised States.

Mr. JAMES MOWATT asked Mr. Bates whether the watershed between the two great river-systems of the La Plata and the Amazons was such that it was possible some connection might be formed between them, or whether there was anything in that part of the world corresponding to the phenomenon known as bifurcation; such as that of the Cassiquiare, which connected the Orinoco and Amazons.

Mr. BATES replied that he believed there was no instance known of bifurcation connecting the tributaries of the La Plata and those of the Amazon; but in the west, near Sucre, in the wet season, the country which

forms the watershed between the Paraguay and the Madeira being level, and marshy, becomes flooded, and enables canoes to pass from one river-system to another; but no regular commerce was carried on in this way. Of course canals might be constructed at very little expense. The highest elevation of the watershed could not be more than 1000 or 1200 feet. Traders very often pass from Paraguay up the river, and then across to the River Tapajos, and so descend in canoes to the city of Santarem on the Amazons. When those countries become peopled there can be no doubt whatever that canals would be made connecting the rivers, or avoiding rapids, so that a vast system of internal navigation would be completed throughout the whole of the interior of South America.

Sir HARRY VERNEY said that when he was in South America five-and-forty years ago Sir Woodbine Parish told him that the Spaniards, the Brazilians, and the Portuguese had ascended the rivers and fought battles in those very marshes to which Mr. Bates referred. There could, therefore, be no doubt that commercial enterprise would ultimately be able to find its way throughout the whole of the interior of South America. The great difficulty of travelling there arose in his day from the Indians, who swept over the country on horseback in large hordes, destroying every creature they met with. The only chance a traveller had of escaping was to throw down his baggage and gallop away in an opposite direction to that in which the Indians were coming. The dogs of the Pampas had the extraordinary faculty of setting up a peculiar howl at the approach of the Indians, and no traveller ever ventured into the country without dogs.

The CHAIRMAN, in summing up, said that Professor Levi's paper was one that did not contain merely dry geographical or statistical details, but dealt in a liberal spirit with the whole subject. He would commend that manner of treating a country generally to the Fellows of the Society. Dry journals of travels, which were very valuable for their geographical details, were not so generally interesting as a paper like that which Professor Levi had just read.

*Fifth Meeting, 26th January, 1874.*

SIR H. BARTLE E. FRERE, K.C.B., K.C.S.I., &c., PRESIDENT, in  
the Chair.

PRESENTATIONS.—*W. White Cooper, Esq.; Henry Douglas Bell, Esq.; Geo. Lewis Parkin, Esq.; Thomas Devas, Esq.*

ELECTIONS.—*C. F. R. Allen, Esq.; Capt. Lionel Neville Frederick Ames (Grenadier Guards); William Moore Bell, Esq.; Capt. H. F. Blair, R.E.; William Boyd, M.A., F.R.S.E.; Granville Bridgeman, Esq.; Charles Gilbert Brown, Esq.; Thomas Ryburn Buchanan, Esq.; Dr. Bushell, M.D.; W. Cartwright, Esq.; Harry Walter Cholmley, Esq.; Lieut.-Col. E. Staines Daniell; Duncan Davidson, Esq.; Edward Dowling, Esq.; William Erill, Esq.; Commander O. A. Forssman (Consul for Portugal); Lieut. W. J. Gill, R.E.; James Henry Stuart Graham, Esq.; Edward Hairby, Esq.; Capt. Francis Handley (late India Navy); Dr. Samuel S. Heard; Lieut.-Col. James Hills, V.C., R.A.; John Kennedy, M.D.; Andrew James Livingstone Learmonth, Esq.*

*Donald H. Macfarlane, Esq.; Stephen Mason, Esq.; Charles Edward Matthews, Esq.; Lieut.-Col. Alfred Pearson; Edward Power, Esq.; James Reynolds, Esq.; James Lionel Ridpath, Esq.; Edmund Routledge, Esq.; Rupert Smith, Esq.; Duke of St. Albans; T. Waters, Esq.; Robert Wharton, Esq.; H. E. Wodehouse, Esq.; Charles Edward Baring Young, Esq.*

ACCESSIONS TO THE LIBRARY FROM JANUARY 12TH TO JANUARY 26TH, 1874.—‘Comparative Grammar of the Egyptian, Coptic and Ude.’ By Hyde Clarke, 1874. Donor the author. ‘Navigation of the Atlantic.’ From the French of M. F. Labrose; by J. B. Coghlan. Washington, 1873. Donor Commodore R. H. Wyman, U.S.N. ‘Acrididae of North America.’ By C. Thomas. Washington, 1873. Donor F. V. Hayden, Esq. ‘Antiquitates Americanæ. Edidit Societas Regia Antiquariorum Septentrionalium.’ 1873. Donor Sir David Dundas. ‘The Cruise of the *Curaçoa* in 1865.’ By Julius L. Brenchley. 1873. By purchase. ‘Mémoires sur les principaux Travaux d’utilité publique en Égypte.’ Par Linant de Bellefonds Bey. With Atlas. Paris, 1872-73. Donor the author. ‘Central Asia and its Question.’ By Col. Sir F. J. Goldsmid, C.B. 1873. Donor the author. ‘The Land of the White Elephant.’ By F. Vincent. 1873. Donor the author. ‘Sixth Annual Report of the U.S. Geological Survey of the Territories.’ By F. V. Hayden. Washington, 1873. Donor the U.S. Geologist. ‘La Isla de Pascua i sus Habitantes.’ D. R. A. Philippi. Santiago de Chile, 1873. Donor the author. ‘Algebraiske Funktioner af  $x$  og  $y$ .’ Af P. C. V. Hansen. Copenhagen, 1873. ‘Thermochemiske Undersogelser.’ Ved J. Thomsen. Académie Royale de Copenhagen.

ACCESSIONS TO MAP-ROOM SINCE THE LAST MEETING OF JANUARY 12TH, 1874.—West Africa.—MS. Map of the Brass River (Niger Delta). Presented by the author, A. MacEachen, Esq., F.R.G.S., West Africa.—Tracing of the Pombeiros’ route from Muata Hianvo to Cazembe. Presented by A. Johnston, Esq., F.R.G.S. South Austria.—Map showing heights. By A. Steinhäuser. Presented by the author. A Map showing the Rivers Congo, Gaboon. Presented by R. Kiepert, Esq. United States of America.—4 Maps, viz.: 1. Geological Survey of Yellowstone National Park; 2. Parts of Idaho, Montana, and Wyoming Territories; 3. Map of the Upper Geyser Basin, Fire Hole River; 4. Map of the Lower Geyser Basin, Fire Hole River. Atlas of the Suez Canal, with views. By Linant de Bellefonds Bey. Presented by the author. Map of Ashantee and Gold Coast. Map of London, showing Railways. Both presented by the publishers, C. Smith and Son. Ordnance Survey. 141

Sheets of Parish Maps. Presented by the First Commissioner of Works through Sir H. James, Director of Survey. Geological Map of California and Nevada. Presented by Professor Whitney, Corr. Mem. R.G.S.

The PRESIDENT, referring to the telegram of Dr. Livingstone's death, which had just appeared in the evening papers, said that members of the Society who knew Eastern Africa well were inclined to doubt the accuracy of the report.

The following Paper was read by the author:—

*Geographical Notes of the Khedive's Expedition to Central Africa.*

By Lieut. JULIAN A. BAKER, R.N.

HAVING had the honour of being entrusted by Sir Samuel Baker with the topographical department, in the late Expedition of His Highness the Khedive of Egypt for the suppression of the slave trade, I venture to submit to the Council of the Royal Geographical Society the following Report of the countries visited during the expedition.

Of the journey from Cairo to Khartoum it will be unnecessary to speak: but, on arrival at Khartoum, we found that there were no vessels ready for the shipment of the corn and stores requisite for the Expedition, nor for the steel boats designed by Messrs. Samuda for the navigation of the great lake Albert N'yanza. Giaffer Pacha, the Governor-General of the Soudan, being urged by Sir Samuel Baker, at length succeeded in hiring thirty-one boats, with which we started on the 8th February, 1870.

Previous to leaving Khartoum, we heard that the White Nile was choked up just above the junction of the Bahr Gazal, and that the stoppage extended for an immense distance, entirely obstructing the navigation of the river. This stoppage or "sud" is mentioned by Sir Samuel Baker in the 'Albert N'yanza, Great Basin of the Nile,' vol. ii., p. 329 *et seq.* It was then in its infancy, but during the lapse of years had assumed its present gigantic proportions, which are every day being increased by the deposit of fresh vegetable matter by the river above. The traders, we were told, were obliged, in consequence, to travel by the Bahr Zaraffe, or Giraffe River, which is an arm of the Nile, leaving it in lat. 7° N., and meeting it again in lat. 9° N., about 36 miles above the confluence of the Sobat.

During the last year we were told that the Bahr Zaraffe also had become obstructed, and that there were very shallow places in it, over which the boats would have to be dragged. By all accounts,

however, the extent of these obstructions was very small, ranging, amongst a number of informants, from 30 to 100 yards.

We passed Fashoda, lat.  $9^{\circ} 54' N.$ , long.  $32^{\circ} 26' E.$ , on February 14th, 1870. This is a most unhealthy spot, surrounded by marshes. It is governed by a Bey and garrisoned by 400 men, all of whom have been sent here for punishment. After taking in some further supplies, we started again, and passed the Sobat on the 17th February. This grand river was then bank-full, and about 250 yards wide, running with such a strong stream that it banked up the Nile, the water of which was quite dead for some distance above the junction.

We arrived at the mouth of the Bahr Zaraffe on February 18th, 1870, and travelled for 272 miles up this river. At the mouth it was about 60 yards in width, but at this point it had decreased to about 20 yards. There was a raised piece of ground here, about 10 feet above the river, on the right bank, which was called by the Arabs a "dubbah." I subsequently took the latitude and longitude of this place. About a mile above the "dubbah" the river was entirely lost, and we came to a stop in the middle of high grass, without a vestige of a channel in any direction, and no signs of water even from the masthead. Here the guide declared himself to be at fault, and we were consequently obliged to return for 80 miles, where we found our fleet coming along slowly, being towed by the men on the bank. Having taken a fresh guide we proceeded again to the "dubbah," the fleet arriving before us, owing to a fair wind.

On March 8th we began to cut a passage for the boats, and on March 13th we were obliged to take the paddles off our two steamers, as the channel was too narrow to allow the paddles to revolve. The channel was cut in the following manner:—The men were placed along the line where the grass grew thinnest and the water was deepest, which was easily found by sounding with a pole pushed through the floating mass of some five feet of tangled roots and slime, and then, armed with swords, they commenced to cut through this mass, the men stationed on each side hauling the grass out, and throwing it on to the bank which was thus formed. When the channel was sufficiently cleared, the grass forming the bank was tied back to the green grass on each side, to prevent it from rolling back into the channel again. This sort of work continued till March 29th, a few lakes intervening. We then reached the clear river, and proceeded for 13 miles, the water getting shallower and shallower, until at last Sir Samuel Baker's little dahabiah, drawing only 2 ft. 6 in. of water, could not go any further. Taking

the dingy, we found that a little further on there was not water enough even for her, and she had to be dragged over a sandbank. Beyond this, the water was nowhere more than 2 ft. 6 in. deep, and our vessels required 4 ft. We were too late in the season. We ought to have started from Khartoum in the end of October, when the northerly winds commence to blow, and the river is high, but, owing to delays in Cairo, we had only started from Suez on December 5th, 1869. It was necessary to return, and Sir Samuel Baker had noticed a place on the right bank of the Nile, 6 miles below the junction of the Sobat, as a suitable place for a camp in case of necessity. Sir Samuel Baker called the officers and explained the circumstances to them, and we sadly, but the Egyptians gladly, turned our boats' heads down stream for the return journey on April 3rd, 1870. There were two "dubbahs" at this place, one on each side of the river, and a third one a little further back on the left bank. The river had fallen so rapidly, and the grass had closed in so much, that we did not get back to the "dubbah" till April 10th. Here we again mounted our paddles on the two steamers, and steamed down stream, arriving at the Nile on April 19th. We met Mr. Higginbotham, the chief engineer of the Expedition, on April 21st, with eleven boats, bringing up the sections and machinery of one of the steel steamers of Messrs. Samuda.

On April 25th we chose a place on the right bank of the Nile, 6 miles below the Sobat junction, as a station in which to pass the rainy season. Sir Samuel Baker named this place "Towfikia," in honour of the Viceroy of Egypt's eldest son, Mahomed Towfik Pacha. I fixed the lat.  $9^{\circ} 25'$  N., long.  $31^{\circ} 24'$  E., variation  $7^{\circ} 45'$  W. Iron magazines were erected, and all our goods and merchandise for traffic with the natives were placed under shelter.

During our stay here, we heard from the Shilooks (the natives of this part of the country) that they knew of a channel by which to pass up above the obstruction of the Nile. Sir Samuel Baker accordingly made preparations for an exploring expedition to ascertain if this were really true. A steamer and noggur (Nile boat) were loaded with picked wood of the best possible description (Sunt, the *Acacia Arabica*), and, on August 11th, we started.

On August 12th, 1870, after having travelled about 95 miles from Towfikia, we turned out of the main river, up which we had been steering w.n.w., into a large branch west by south. This channel twisted and turned about very much; but at last, after a good deal of trouble in cutting through grass, we got into the Nile again, on August 14th, which was running about two miles per hour, and

was 160 yards wide. I will here insert some extracts from my journal :—

“ *Sunday, August 14th, 1870.*—Steam up at 5.50 A.M. We had to cut through the passage that the dahabiah took yesterday, and got into the Nile at 8.30 A.M., then had to wait until the steamer had filled up with wood from the noggur (Nile boat).

“ At 1.30 P.M., got under way, leaving the noggur to wait for us. At 1.40 P.M., a mountain bearing N.N.E., about 40 miles distant. 2.40: The river divides, one branch coming from the west, the other from west by north-half-north. We took the west branch. 4.30 P.M., finding the river closed, numerous tofes (floating islands) obstructing the passage in different places, we returned. Water shallowed to about 5 ft. 6 in.

“ At about 5.5 P.M., turned off to examine the other passage. Finding this difficult of approach, anchored for the night at 5.25 P.M.

“ *Monday, August 15th.*—Went in the boat to try and discover a passage. Found the large river close to us on the west, running about three knots. Sir Samuel Baker went off in another boat to the north-west, and found evidences of the traders having passed there—pieces of rag, &c., lying on the broken grass.

“ Got under way at 10.30 A.M., and got into the river almost immediately, without any trouble. We went on for about four miles, steering west-half-south, and then found the river closed up. A large sheet of water, however, was to be seen from the masthead, extending from the west to north-west. We found a small passage large enough to admit the boat, and through this, with some difficulty, we proceeded until we arrived in this lake, which at this point was about two miles wide, but apparently much wider to the westward, there being there a sea horizon. We then returned, there being no practicable passage for the steamer, and came back to where we had started from this morning. Here we again took the boats to search for another passage, but without success. Sir Samuel Baker then determined upon cutting a passage into the large lake that we got into this morning, and for that purpose steamed up the river again, and anchored, at 6 P.M., opposite the small channel up which we had gone in the boat. To-morrow we shall get all hands to work, and cut through.

“ *Tuesday, August 16th.*—Raining in the forenoon, but after breakfast got all hands to work, and began cutting a passage. Cleared about fifty yards on the lake side, and then, as it was getting late, knocked off work for the day.

“ *Wednesday, August 17th.*—Set to work at 8 A.M., and worked till

10 A.M., then from 2 till 5 P.M., by which time we had nearly completed the passage.

"*Thursday, August 18th.*—A blowing morning, too cold to allow the men to work in the water; but, after breakfast, set to work and finished the passage.

"*Friday, August 19th.*—Up steam at 6 A.M., and attempted to get through. Shallow water, however, delayed us for a long time. We breakfasted at 2 P.M., and then at last got through at 4 P.M.: had the dahabiah in tow at 4.5 P.M., and proceeded. A river coming into the lake from the southward, stopped at 5.25 P.M. to examine it, but found it choked. Anchored for the night at 6.15 P.M. in a little harbour to the southward.

"*Saturday, August 20th.*—Steam at 5 A.M., under way at 5.20 A.M., and proceeded to the westward, following the curves and bends of the side of the lake. At 6.5 A.M. set the course E.N.E. to return, having arrived at the farthest limit of the lake. At 6.45 stopped as we neared the passage through which we had come, and turned off to examine the northern shore of the lake. This lake is about 15 miles long, and varying from 2 to 3½ miles in breadth. Skirted round the lake till at 8.40 A.M. we again arrived at the little harbour that we started from this morning. Started again at 8.50, and five minutes afterwards turned into the river that we had looked at yesterday. Stopped the steamer here and went up the river in the boat, but found it stopped up about a mile from the lake. Lost our way in coming back, as the different hors (channels) are so much alike. Got back at 11.15 A.M., then proceeded to skirt the southern shore. Turned off from this at 1 P.M. to examine a large hor or river on the north side, which Sir Samuel Baker had seen this morning. Arrived at the entrance at 1.25 P.M., and proceeded up the hor till 2.45 P.M., when it was completely blocked up. Observed that another arm of this lake ran nearly parallel with the arm we had steamed up, the water of which we could see to the westward at this point. No stream perceptible. We immediately returned to the point of confluence of the two arms, and turned up the other arm at 3.20 P.M.

"Stopped at 4.20 P.M., and after consulting the reis Omar, who said that we were long past the junction of the Bahr Gazal, turned the steamer's head round to return. The upward course of the Nile from the Bahr Gazal being S.S.E., we must have passed that also, as our course up this arm has been W.S.W. It would be of no use going any further along this arm, which appears to extend an immense distance, as we should evidently be only going further out of our way, and burning fuel to no purpose. No stream at all.

The whole of this lake, and these arms, of which there are several, are simply the accumulation of the overflow of the waters of the Nile, which extend in every direction in the shape of hors, the country being so perfectly flat. Stopped at 6.5 P.M. at the mouth of this hor.

*"Sunday, August 21st.—Started at 6.5 A.M.; stopped at 6.37 A.M. opposite our cutting, in order to let the dahabiah pass first. Cutting bearing from mouth of river S.S.E. Got through the cutting at 7.5 A.M., and proceeded. Arrived opposite the noggur at 9.20 A.M., the average course having been east by north. Got through here without trouble, and having filled up with wood from the noggur, proceeded at noon. At 1.35 P.M. turned off into the Nile; 4.35 P.M. stopped to land our Shillook guides opposite their village. Proceeded again at 5.35 P.M., and arrived at our station at 12.30."*

I made a small map of this part of the Nile, but was unable to fix the positions astronomically, as there was no dry ground anywhere, and the grass was from 10 to 12 feet high. Although we had actually passed the original obstruction or dam by a side channel, we had found the river blocked up 20 miles above this by a new formation, the extent of which it is impossible to estimate. This had no effect upon the stream, which oozed out from under the floating grass, and, in the main channel of the Nile, ran from 2 to 2½ miles an hour, being perfectly clear and free from vegetable impurities. It became necessary for Sir Samuel Baker to go to Khartoum, about 700 miles from Towfikia, in order to hasten the departure of some more boats laden with the sections and machinery of another steamboat of Messrs. Samuda. Whilst there, I took the opportunity of rating the chronometers, and with them determined the longitude of Fashoda and Towfikia.

On our return to Towfikia we found that the river had risen to such an extent that our camp was surrounded with water, and most of the cultivation was flooded.

On November 5th, 1870, the river attained its maximum, being 14 feet 3 inches above the level on our arrival on April 25th. It fell a quarter of an inch on November 6th. The northerly winds had not yet commenced to blow steadily, but Sir Samuel Baker arranged everything so as to be ready for a start as soon as they should commence.

On December 1st the first division of 8 boats was started off, followed by others every day, until the last division with Sir Samuel Baker started on December 11th. We had steamed for 150 miles up the Bahr Zaraffe, and were cutting wood for the steamer, when some of our boats that we had passed arrived, and told us

that a vessel loaded with machinery had sunk just opposite the Sobat River. Steam was got up immediately, and we started back, taking three boats with us. We met the Colonel in command of the troops, who had been there when the accident happened, but had not made any attempt to save the vessel.

We returned to Towfikia, and persuaded the King of the Shilooks to help us with a number of natives. While these were being collected, we went a short distance up the Sobat, where there was a suitable place, got the masts and cargoes out of our three vessels, and towed them with the steamer down to the wreck, which had about two-thirds of her masts above water, lying close alongside the west bank of the Nile, with the whole force of the stream of the Sobat rushing down upon her. Chains were passed under her bottom, and hove upon from the vessels, which were nearly filled with water. Upon baling out the water, she, of course, rose slightly, and men on the bank, assisted by the natives, hauled upon hawsers and secured her to anchors which were laid out on the bank for that purpose. By repeating this process, after working hard for two days and a half, she was safely hauled up on the bank, and baled out dry, when it appeared that the caulking had come out in several places. The valuable cargo of machinery was saved, without damage.

These Upper Nile boats are most curious specimens of naval architecture. There are no ribs, but the planks are laid one on top of the other, and large nails are driven in diagonally from both sides. They are caulked with rags from the *inside*, and the seams are not payed with pitch. In consequence, the rats, which swarm in all these boats, pull out the rags, and the boat is constantly leaking, and every now and then there is an accident, and a boat sinks.

We arrived at the "dubbah" Bahr Zaraffe, on January 7th, 1871, and I fixed the latitude  $7^{\circ} 47' \text{ N.}$ ; longitude,  $30^{\circ} 22' \text{ E.}$  Our old channel that we had cut the year before was now tolerably open, but gave us a good deal of trouble.

We arrived at the three dubbahs on January 29th, and I got lat.  $7^{\circ} 32' \text{ N.}$ , long.  $32^{\circ} 23' \text{ E.}$  From this point we had the greatest difficulties from the shallowness of the water and the obstructions of the grass. In some places every available man had to turn out to haul each of our fifty-nine boats over a shallow place separately, and on one occasion we had to increase the depth of a channel, 500 yards long, from two feet to four. This, of course, was the work of many days, during which time the water was sinking two and three inches per day. It at last was so low, that when after an immense

amount of labour we got our fleet into a small lake, the mud oozed up above the surface of the water, as the last boat was dragged in. We prepared to make a dam behind the boats, to enable us to push on. Mr. Higginbotham, the chief engineer of the Expedition, had a number of stout posts, 4 inches square, driven into the bed of the stream, behind the last boat, backed up by a similar row behind them, with struts from one to the other. In the mean time, 500 corn-sacks were filled with sand and earth to form a foundation for the dam, and the soldiers and boatmen mixed grass and mud together into large balls, which were piled on each side of the river in great heaps, ready to be thrown in on the word being given to commence the dam.

On March 13th, 1871, they set to work and threw the sacks and clods of earth into the river just above the framework, pounded it down with their feet, and in a short time made a most effectual dam. The water rose directly, and our fleet was afloat again. Still there was a great deal of hard work to be done before we got into the Nile, which at length we did on March 19th.

On April 15th, Sir Samuel Baker, with his dahabiah in tow of the steamer, arrived at Gondokoro, the last boats of the fleet not arriving till May 20th, having been delayed by foul winds and calms. A station was formed here, which Sir Samuel Baker named "Ismailia," in honour of His Highness Ismail Pacha, the Khedive of Egypt. Lat. $4^{\circ} 54' 30''$  N.; long.  $31^{\circ} 46' E.$ ; var.  $9^{\circ} 8' W.$ ; elevation, 1526 feet.

Ismailia is situate upon a cliff about 25 feet above the river; it is on the east bank, and is the only spot suitable for a camp. It has its disadvantages, however, being bordered on two sides by marshes, and on the third by the river. The effluvium from these marshes, after the river has risen and fallen again, is horrible, and gives rise to a good deal of fever; but, during the season of the low Nile, it is healthy but hot. During the rainy season, the Nile does not rise gradually, as might be supposed. It is subject to a series of sudden flushes, which, rising in about ten or twelve hours to a height of 4 feet, fall again, in about the same time, to the original level. The maximum height of floods at Ismailia is not more than 4 feet 6 inches above the lowest level. This rise always takes place after heavy rains have been observed to the southward, and is caused by the immense volume of water which the Ashua, Unyama, and other streams bring down from the upper country, to say nothing of the vast quantity which pours into the Nile itself from the high mountains, which line its western bank.

At Ismailia itself the rainfall is very uncertain, and the crops of

the natives in the immediate vicinity are often destroyed by drought. I attribute this to the attraction of the rain-clouds by the mountains which lie at a considerable distance, as Belignan to the south-east, Lardo to the north, and Kerek and Kunifee to the south-west. Rain is constantly seen falling at these mountains, where the cultivation is naturally productive; but at Ismailia it frequently happens that the natives have to buy corn from their more fortunate neighbours.

The soil throughout the Bari country is poor and sandy; the natives are therefore obliged to manure the ground heavily to make it produce their crops. They till the ground with a sort of hoe, shaped exactly like the ace of spades, which is fixed to a handle about 9 feet long. This is pushed before them as they walk, cutting the roots of the grass, and just scuffing the surface of the ground. The corn is then sown, and the weeds left on the ground until the corn has sprouted, when they are gathered into heaps and burnt. The natives are a fine active race of men; well armed with bows and arrows and lances. Few of them carry shields.

The women are decently dressed in a sort of kilt made of dressed leather, but the men are naked. They are of a very intractable and treacherous disposition, and cannot be prevailed upon to serve as porters.

When the time came for us to depart from Ismailia for the interior, we found that we could not procure porters to carry our 50-foot steamer of 10-horse-power up to Ibrahimyea, at the point of junction of the Unyama with the Nile, so, forming a small station at the highest navigable point of the Nile, in lat.  $4^{\circ} 38' N.$ , we pushed on to Loboré, a place that Sir Samuel Baker fortunately knew of, from his former experience in the country. Here we obtained porters, but not in sufficient numbers for the transport of the steamer. However, we got enough to bring on a considerable quantity of merchandise for traffic with the natives. These porters went back to our station on the river in lat.  $4^{\circ} 30'$  under the escort of forty soldiers, and in a few days returned, bringing the baggage.

From Ismailia to Loboré the soil is very poor and sandy, but beyond Loboré it is exceedingly rich, and produces large crops of dourra (*Sorghum vulgare*). Loboré is in latitude  $4^{\circ} 1' 30'' N.$ . I could not fix the longitude by astronomical observations, but I believe it to be accurately laid down in my map by bearings.

From Loboré to the Ashua River, at the junction with the Attabbi, a distance of 27 miles, the soil is rich, but the country very thinly inhabited, owing to the depredations of the slave-hunters. The natives speak the Madi language, as also do the Loboré people, but with dialectic differences.

At the confluence of the Ashua and Attabbi, the river Ashua is about 130 yards wide, with a sandy bottom, and when we crossed it on March 1st, 1872, and also on March 24th, 1873, it was about knee-deep. Both above and below this point it is full of rocks, and is everywhere a most dangerous and formidable river in the wet season. The natives manage to cross it near Fatiko, with a rope fastened to the trees on each side, which must be laid across in the dry season.

From the Ashua to Afuddo, at the junction of the Unyama with the Nile, the route lies over hills of about 1000 feet above the surrounding country, and is stony, and covered with low open forest of scrubby trees. Upon descending the hill on the south side, there is a beautiful position for a station, on the stony dry ground just to the north of the Unyama, and east of the Nile. Close to water, but perfectly dry, with every facility for cultivation in the wonderfully rich soil on the banks of the Unyama within a short distance, and with an unlimited amount of wood for fuel in the adjacent forests, this place offers advantages for a station that very seldom occur. The latitude is  $3^{\circ} 34' N.$  I was unable to fix the longitude astronomically, but by bearings I am confident of its being rightly placed in the map. From this point the Nile is navigable into the Albert N'yanza, therefore Afuddo, or Ibrahimyea, as Sir Samuel Baker has named it, will be the great dépôt for all the ivory that comes down from the shores of Lake Albert N'yanza. Here Samuda's steamers will have to be constructed after they have been carried up in sections from Ismailia, and from here they will take their departure to navigate the lake. Ibrahimyea will become the capital of the country. The road from Ismailia to Ibrahimyea, 120 miles, is for the greater part of the way suitable for carts, the soil being very hard and sandy. Between Moogi and Loboré (14 miles), there is forest, through which a road will have to be cleared, but a few hundred men would very soon accomplish this.

Continuing the journey over an undulating country, for the most part covered with forest, we arrived at Fatiko on March 6th, 1872. Fixed the position, lat.  $3^{\circ} 2' N.$ ; long.  $32^{\circ} 37' E.$ ; var.  $8^{\circ} 30' W.$ ; elevation above sea-level 3542 feet. The natives of Fatiko speak the Shooli language, in common with the people of Lira and Umiro. The men usually wear a skin slung over their shoulders in such a manner as to form an apron, and the married women wear a long tassel behind, and a triangular piece of leather in front, but the unmarried girls are perfectly naked. Both men and women work in the fields. The hoe is similar to that used in the Bari country; but instead of being mounted in the same way, it is fixed to a short handle in such

a manner that the hoe is nearly at right angles with the handle. This makes a very powerful instrument, and with it they dig into the soil a considerable depth. They never manure their land, but



End view.



Side view.



The handle.

sow the same ground one year after another, getting good crops every time; such is the wonderful richness of the soil.

The dry season lasts for two months, January and February; and during the rest of the year the weather is very much like the summer in England, but hotter. It may rain for two or three days successively, but rarely all day. It generally comes on to rain in a heavy shower, lasting from half an hour to three or four hours, and then clearing up. There are frequently five or six days together without a drop of rain, even in the middle of the rainy season. The whole country is beautifully watered by streams which run into the Ashua and Unyama.

From Fatiko to Atada, on the Victoria Nile, the route leads through high grass and forest, and the country is uninhabited.

At Atada, about four miles above the Karuma Falls, the Victoria Nile is 500 yards wide, but with a very slow stream. The banks are from 60 to 80 feet high, covered with most luxuriant vegetation.

From Atada to Masindi, the country is the same as between Fatiko and Atada, the richest soil, covered with high grass and forest; and swampy bottoms in every undulation of the ground.

Both men and women dress decently in Minyoro; a robe of bark-cloth round the waist, reaching to the ankles, and another cloth under the left arm, and tied over the right shoulder, and reaching to the knees, are universally worn by both sexes. The women do all the work in the fields, and use a very light hoe, similar in shape to that of Fatiko, but small enough to be used with one hand.

The soil is a beautiful black loam, is very easily turned up, and is free from stones or clods. It is exceedingly rich. The sweet-potato and banana are extensively cultivated, and form the staple of food in this country; but dourra (*Sorghum vulgare*) and tullaboon (korakan of Ceylon) are also grown. There is also a small kind of Indian corn, but in no great quantity. Tobacco is indigenous throughout the whole of the countries traversed by the Expedition, and is prepared in different ways by the natives, each tribe having

its peculiar method. It being considered *infra dig.* for a man to work in the fields, the men amuse themselves by dancing, singing, drinking, and beating drums all night, and go to sleep for the greater part of the day, while the women do all the work.

From our camp at Masindi we could see the mist rising from the Albert N'yanza in the mornings, and with a powerful telescope could distinguish trees on the mountains on the opposite side of the lake. We could also see a waterfall on the opposite side with the telescope.

Whilst at Masindi, a native of Karagwe told us that it was quite possible to go from Chibero, on the Albert N'yanza, past Uvira to Ujiji by boat. He said that at Uvira the lake was very narrow, and that it could not be passed without a pilot who knew the way. He described the lake as varying very much in width, being immensely wide beyond Vacovia, and again contracting at Uvira. This report was confirmed by a Kisuhili man, who had been living with Mtésa for many years, and who was sent by him to see Sir Samuel Baker at Fatiko. He knew both Uvira and Ujiji, which he called Uyiyi.

Mtésa sent messengers to Ujiji, at Sir Samuel Baker's request, to obtain news of Livingstone, and on their return they said that a white traveller had crossed the Tanganyika (which they called Mwootanzigé, the native name of the Albert N'yanza) from Ujiji, and had not since been heard of, but that if he returned we should be informed of it. Sir Samuel Baker wrote to Mtésa, and gave him letters to deliver to Livingstone, should he find him. Mtésa has turned Moslem, and given up all his savage customs, mentioned by Speke, of slaughtering his women, &c., and he now keeps scribes, and is learning to read and write Arabic. He wrote a most polite answer to Sir Samuel Baker's letter, declaring that he would take the greatest care of Livingstone if he should find him.

In Uganda, coffee and the sugar-cane are cultivated by the natives, who dress in the same manner as the people of Minyoro, but speak a different language.

On our return to Fatiko, we fortified the camp with a ditch and breastwork. This took us several months to complete, as the sub-soil was the hardest gravel, and we had only the natives' worn-out hoes to work with. No trace of any metal, except iron, could be found throughout the country, though Sir Samuel Baker was always examining the rocks, which are all igneous.

Having established the greatest confidence in the country round about Fatiko, we left for Ismailia, where we arrived on the 1st April, 1873, and found that the English mechanics had constructed one of Messrs. Samuda's steel steamers.

We started for Khartoum on the 26th May, and found the Bahr Zaraffe very much improved since the time when we had last passed it, so that we got through without much difficulty. Below the "dubbah," however, the river was very much narrower than before, the grass having grown in from the banks towards the middle, and I believe that in a few years the "sud" will extend about 80 miles north of the "dubbah," where it is now clear.

In the present state of the Bahr Zaraffe, it is quite impossible to say how long vessels may be on the voyage from Khartoum to Ismailia. The troops that were sent up as a reinforcement from Khartoum were 14 months on the road, as they were obliged to pass the season of the low Nile at a station about 120 miles north of the "dubbah." Communication being thus next to impossible, the Bahr Zaraffe cannot be considered a navigable river, and unless the old stoppage on the Nile itself is cleared, the beautiful countries to the south of Ismailia will never be opened to civilisation.

Ismail Pacha, the Governor of Khartoum, went up in 1872, at the proper season, with a large force, and cleared away a great part of the original Nile stoppage, and he intended to go up again in October, 1873, to try and finish it. Should he succeed, and open the river to navigation between Khartoum and Ismailia, one of the greatest difficulties that we had to contend with, namely, want of communication with Egypt, will have disappeared. It will then be easy for steamers to run every month or so with the mails, or whatever is required at Ismailia, returning each time laden with ivory, and there may be a great future for the country.

In conclusion, I beg leave to express my high opinion of the merits of Captain George's Artificial Horizon, one of which I used throughout the expedition, and which I consider to be a most perfect instrument. During the whole of the expedition I never had occasion to replenish the mercury, whereas with the common form of horizon, the mercury is constantly being wasted. The floating glass answers the purpose admirably of preventing any tremor, and the advantage of being able to fill or empty the receiver without any risk of losing mercury is very great.

The PRESIDENT, in asking the meeting to express their thanks to Lieut. Baker for his paper, stated that the astronomical observations he had made during the whole expedition had been sent to Mr. Ellis of the Royal Observatory at Greenwich, to be worked out, and that the Council had that day received a most satisfactory preliminary report from the computor, upon the value of the observations.\* According to our Naval Regulations,

\* The following letter has been received on this subject:—

"The Astronomical Observations by Lieutenant Baker which have been placed in my hands for reduction, consist of observations of meridian altitudes for latitude,

Lieut. Baker has sacrificed his professional advantages by his long sojourn in Africa, but he (the President) hoped that no rigid interpretation of rules would be allowed to exclude from the service so able an officer.

Sir S. BAKER said he had often heard it suggested that there was something in the climate of Africa which rather destroyed the *moral* of travellers, and created jealous feelings among them; but, for his part, he wished to give all possible credit to those who were his precursors in the route from Zanzibar to Gondokoro, namely, Captain Speke and Colonel Grant. Every African traveller was aware of the ease with which geographers in England could lay down theories, but the duty of a traveller was not to form theories; he should examine the country carefully, cross-examine the natives, and, on his return home, simply and straightforwardly tell exactly what he had seen and heard. With regard to the sources of the Nile, it would be quite an impossibility for him (Sir S. Baker) to say for certain whether or not the Tanganyika Lake was connected with the Albert N'yanza, but during his recent expedition he had heard accounts from native merchants which had shaken his faith in the opinion he had formerly expressed that there was no connexion between the two lakes. Two merchants had told him that they had formerly travelled from one lake to the other by boats, but had ceased to perform the journey in that way because the canoes were too small to carry the ivory. These men had no object in telling a lie, no interest in deceiving him. Some months after this, the envoys whom the Sultan of Uganda sent to Fatiko, gave him a detailed explanation of the geographical features of the country. They said that the lake Victoria N'yanza, discovered by Speke and Grant, bore the name of Sessi. The natives had formerly stated to Speke and Grant that Sessi was the name of an island in the lake; but these envoys said, not that there was an island in the lake, but that if a person wanted to inquire for the Victoria N'yanza he must ask for Sessi. The lake, they added, was divided into two parts, with a connexion between them, which a canoe required a day to pass through. Both of the lakes bore the name Sessi, but they drew a distinction between the Victoria N'yanza and the Albert N'yanza. This latter lake, they said, was a continuation of the Tanganyika, the whole bearing the name of Mwootanzigé, which was applied to the Albert N'yanza in Unyoro. They gave the names of every country consecutively, from Vacovia, along the edge of the lake, down to Ujiji, but declared that no one knew anything of the southern extremity of the Mwootanzigé. He did not state this as his own theory, but as what he had himself heard. On the other hand, Colonel Grant contended that Speke and Burton discovered, in the Tanganyika, shells which had not been found in the Albert N'yanza, but those shells might exist although they had not yet been met with. Then Captain Burton had stated that the palm which produced the palm-oil grew on the shores of Tanganyika, while it was never found on the borders of the Albert N'yanza; but it was quite possible that this might be accounted for by differences of soil. The channel near Uvira was described by the natives as excessively narrow and winding, so that no stranger could possibly find his way through. Considering the large masses of floating islands in the Albert N'yanza, which broke adrift from the shores

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and observations of lunar distances, some eclipses of Jupiter's satellites, and determinations by chronometers, for longitude. The calculation of the latitudes is nearly complete, as well as the local times for reduction of the lunars, but the lunars are not yet calculated. So far, however, as the observations are reduced, the results obtained are satisfactory. The positions of some points in Sir S. W. Baker's map of 1864 will be changed. Fatiko, at which place numerous observations were made, will be shifted 10' or 12' more to the north. As respects the longitude, however, nothing can be yet said.

"January 26, 1874."

"WILLIAM ELLIS."

during a high wind, it was very possible that if at any part the lake was exceedingly narrow it might become choked, precisely in the same manner as the Nile became choked. In such a case the force of the water would always create little labyrinth-like currents, which of course would render it almost impossible for a stranger to get through. On his first voyage to the Albert N'yanza, after he descended the mountains to Vacovia, the country was flat for about a mile to the actual shores of the lake, and bore evidences of having been submerged. The conclusion to which he came was that in remote ages the lake extended to the very base of the mountains. The trees also bore unmistakable marks of the level of the lake having at one time been considerably higher than at present. He was convinced that the water had lowered at least 10 or 15 feet, and the quantity of vegetation thus set adrift would, with a high wind, block up the narrow parts, there decompose and sink to the bottom and form shallows, upon which other vegetation would grow until a general block would be caused. Now, when it was remembered that the Tanganyika received its rainfall at the season of the rainfall south of the equator, while the Albert N'yanza received its rainfall at the season of the rains north of the equator, it was easy to imagine that to keep up the equilibrium between the two lakes, there must be a constant flux and reflux. On the 30th May, 1869, Livingstone addressed a letter to Sir Roderick Murchison, in which he said, "Baker's lake and this (Tanganyika) are all one water." That was what Livingstone heard at Ujiji, and he (Sir S. Baker) had heard exactly the same account at the north end of Albert N'yanza. Again, Livingstone took observations on the Tanganyika, with a Casella's thermometer, and the results obtained were within 72 feet of those which had been taken by him (Sir Samuel) with a Casella's thermometer at Vacovia, a distance of 350 geographical miles from Ujiji, in a direct line. It was difficult to suppose that there should be such a freak of nature as two enormous lakes, one south of the equator and one north, very near each other, and both on the same level. No matter what energy a commander of an expedition might show, he was always to a great extent dependent upon his officers who had to carry out the details, and he (Sir S. Baker) bore unhesitating testimony to the assistance he had received both from his nephew and from the late Mr. Higginbotham, the professional engineer to the Expedition.

Dr. Kirk, referring to the newspaper account of the death of Dr. Livingstone, said, just before he left Zanzibar, on the 18th December, a report was current in the bazaar, to the same effect as that which had just reached England. He had taken every opportunity of enquiring into its truth, and the conclusion he came to was that there was no foundation for the report. Since then a steamer had left Zanzibar for Aden, and no doubt the rumour was brought by that vessel. The facts were simply these:—An Arab intimately connected with the trade of Unyanyembe had received a message from one of his slaves, who had brought down ivory, that Livingstone had been carried into Unyanyembe, but the Arab himself declared his disbelief of the report. The people of England ought, therefore, to suspend their judgment until the arrival of the next mail, when they would learn if any more definite information had been received at Zanzibar since the 18th December. It should also be remembered that by the last accounts Lieut. Cameron was at Unyanyembe, and if what was stated in the newspapers were true, he would certainly at once have hurried down to the coast with the intelligence. Turning next to the question of the supposed connection between the Tanganyika and the Albert N'yanza, he said the common opinion of the natives certainly was that the two lakes were really only one. Some Arabs stationed at Ujiji had even told him that they had passed in boats through Urundi and into the northern portion of the lake; but on enquiry he did not think their account sufficiently accurate to warrant the connection being shown

on the map. Against this common report of the natives must be placed the positive observations of Dr. Livingstone and Mr. Stanley that Tanganyika was closed in. If, however, the theory was adopted that seasonal differences of level might occur, owing to the rains, the Albert N'yanza being north of the equator and the Tanganyika south, and if the connection was very narrow, then the difficulty might be solved; but the question could only be properly settled by actual observations.

Colonel GRANT said that Captain Speke and himself passed through the swampy country about the Bahr-el-Ghazal and the Bahr-el-Giraf (Bahr Zaraffe), during the month of February. It was then covered with water, with not a foot of dry ground to be seen. The Bahr-el-Giraf was then a rapid stream, running about four miles an hour. They had crossed the Asswah River, which they were able to wade through, for it was not above knee-deep. South of this river the character of the country was altogether changed from what it was on the north. The hills were like those of Scotland or Wales, while the Nile banks were rugged and rocky. Towards Unyoro, however, the mountains disappeared, and the soil was exceedingly fertile. In 1857-8 Burton and Speke discovered Tanganyika Lake. They then went on to Uvira, from whence they saw mountains all around the head of the lake, and Speke put down on his map several streams running from the north. The two travellers were there four months, and two such geographers could never have been there so long without ascertaining the real character of the district, but they never heard of a connection with the Albert N'yanza. Stanley, too, distinctly stated that the waters of the Rusizi flowed into Tanganyika: he writes of the "deltas" formed by the Rusizi and other streams. When he himself travelled with Speke towards Karagwe, they constantly asked the names of the countries to the west, and yet they never heard of the junction of the lakes. At Rumanika's they met traders from all parts, and they also made enquiries of the king, but never heard of water to the west. When, however, they got considerably further north they were told that there was a lake to the north-west. They were not permitted by the King of Unyoro to inspect this lake, but Speke, from native information, laid down its position with such remarkable accuracy that, when Sir Samuel Baker was directed to it by their maps, and had visited its northern and north-eastern shores, he had not to make any material change in this position of the lake as laid down by Speke; but he now represents the lake as extending 180 miles farther to the south than they had any information of. Sir Samuel Baker had stated that the natives near Masindi had told him that the proper name of the Victoria N'yanza was Sessi; but he himself had almost stood upon the island of Sessi, which was frequently mentioned in Speke's work as being at the north-western corner of the lake. The natives whom Sir Samuel Baker saw probably lived near Sessi, and would call the lake by the name of the place. He had carefully considered the question of the shells of the lakes, and it was an extraordinary thing that of the four species brought by Speke from Tanganyika, not one was found in the other lakes, but were all, if he mistakes not, entirely new species, named by Woodward, while the shells of the Albert N'yanza and the Victoria N'yanza were nearly in every case well-known Nile shells, thus indicating separate and distinct basins.

Mr. FINDLAY said Mr. Stanley, in his account of his visit to the north end of Lake Tanganyika, described the coast line as a low, marshy swamp, bordered by the usual gigantic aquatic vegetation, and that it was with great difficulty they were able to find the entrance to the Rusizi River at the north-eastern angle. They were guided into it by some canoes, or they would not have found it. The delta, he said, consisted of three arms; the first being 6 yards wide and 10 feet deep, the second 8 yards wide, and the principal arm 10 yards wide and 2 feet deep, while the current was from 6 to 8 miles an

hour. That, however, was impossible, because it would be a boiling mass of foam with such a current, and no African canoe could make headway against it. This was in the month of December, when the northerly winds were blowing. If when the southerly winds prevailed the elevation of the lake was raised only 6 inches, that stream only 2 feet deep would flow in the opposite direction, and so the Rusizi might both flow into and out of Tanganyika. Another difficulty arose from the statement of Speke, that beyond Uvira nothing but water could be seen as far as the eye could reach, while Stanley made it dry land only 5 miles from the same place. How could these statements be made to agree? The only solutions must be, either that when Burton and Speke were there the southerly winds had entirely covered the low-lying swamp with water, or else that it was drifted vegetation, such as described and suggested by Sir Samuel Baker. Livingstone himself, writing from Ujiji to Sir Thomas Maclear, November 17th, 1871, stated that he had for three months watched the majestic flow of the Tanganyika to the north. Tanganyika must have an outlet; but Livingstone had travelled up as far as Bambarre, and his friend Mohammed Bogharib had reached the Baleggi Mountains without meeting with any stream flowing westward which could be referred to the Tanganyika.

Mr. MAJOR said, from 1578 to 1587 a Portuguese, named Duarte Lopez, resided in Congo, and in 1587 the king of that district requested him to go to Rome to procure missionaries to strengthen the Christian mission there. He accordingly went to Rome, where he dictated to Pigafetta all the information he had gathered respecting Africa during his nine years' residence in Congo. The account was printed in 1591, and accompanied with a map drawn up from Duarte Lopez's description. Curiously enough, in that map the two lakes, the Albert N'yanza and the Victoria N'yanza were marked, while to the south of the Albert N'yanza was another large lake, corresponding to the Tanganyika (though of course the outline was different), and along the stream, joining the two lakes together, was the legend Lagoa do Nilo. The Portuguese word *lagoa* meant a morass, a fen, and this corroborated what Sir Samuel Baker had just said; and it was to be recollectcd that, if this were the true state of the case, and a flux and reflux took place at different times between the two lakes, there would obviously occur variations in their levels—a very important fact in the consideration of this question.

Sir S. BAKER said, the maximum rise of the river at Gondokoro, as ascertained by a nilometer, was 4 feet 6 inches. The Albert N'yanza being one of the parents of the White Nile, it was strange that the rise should be so small, and should only occur in periodical flushes. These flushes could always be foretold by the lightning which appeared in the south, showing that they were caused by heavy rains in that direction. Though the Albert N'yanza and the Victoria N'yanza were the great parents of the Nile, they had little or nothing to do with the flushes of that river, but kept up a steady supply. If the Tanganyika were a contribution of the Albert N'yanza, these flushes could easily be understood, because when the Tanganyika at the south of the equator was at its maximum height of water, there would be a reflux into the Albert N'yanza, and when the Tanganyika was at its minimum, there would be a flow from the Albert N'yanza into the southern lake. This followed from the rainy season occurring in different months in the two lakes. At latitude  $1^{\circ} 37'$  the Victoria Nile was a grand stream, 1000 yards wide, and of immense depth, and even beyond the line the current was about  $1\frac{1}{2}$  mile per hour. It would therefore carry an immense volume of water into the Albert N'yanza, but where did it go? Speke himself was astonished to find the Nile at Gondokoro so small, and he could only explain it by saying that the Mwootanzigé was a backwater. If there was a reflux from the Albert N'yanza into the Tanganyika, it would form a backwater. With regard to

Livingstone's discoveries, he (Sir S. Baker) was perfectly certain that Livingstone was entirely out of the Nile Basin, for he was sufficiently conversant with the Nile drainage to assert that from the equator to the Mediterranean not a drop of water ran into the Nile from the west, the Bahr Ghazal being only a chain of stagnant pools and marshes.

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Sixth Meeting, 9th February, 1874.

The RIGHT HON. SIR BARTLE E. FRERE, K.C.B., K.C.S.I., ETC.,  
PRESIDENT, in the Chair.

ELECTIONS.—*Charles George Barclay, Esq.; Joseph Bray, Esq., C.E.; S. Bristow, Esq.; J. B. Brown, Esq.; Captain F. C. H. Clarke, R.A.; Lieutenant-General Robert Fitzgerald Copland-Crawford, R.A.; Rev. James Davis; A. Folkard, Esq.; Henry Charles Forde, Esq., C.E.; George Knowles, Esq., C.E.; Hon. Robert Henry Manners-Sutton; C. Rous Marten, Esq.; William F. Scholfield, Esq.; Robert Stewart, Esq.; Colonel Frederick Tighe; Captain T. W. Goff; William Thomas Hunt, Esq.; M. Franz Keller, C.E.*

PRESENTATIONS.—*J. Henry Stuart Graham, Esq.; Captain H. F. Blair, R.E.; James Reynolds, Esq.; Matthew Wilkes Richards, Esq.; Duncan Davidson, Esq.; Edward Powe, Esq.*

ACCESSIONS TO THE LIBRARY FROM JAN. 26TH TO FEB. 9TH, 1874.—  
'La Province de Smyrne.' Par C. De Scherzer, traduit par F. Silas. Vienne, 1873. Donor the author. 'Catalogus Bibliothecæ Regiæ Monacensis.' Monachii, 1873. 'Botany of the Speke and Grant Expedition.' Part 2. Donor, Colonel Grant. 'Coast of Brazil, from Cape Orange to Rio Janeiro.' By H. H. Gorringe, U.S.N. Washington, 1873. Donor the U. S. Secretary to the Navy. Bædeker's 'Northern Italy.' Leipsic, 1874. Bædeker's 'Belgium and Holland.' 1874. Donor the publisher. 'Illustrations of China and its People.' By J. Thomson. Vol. III. Donor the author. 'Vom Amazonas und Madeira.' Von F. Keller Lenzinger. Stuttgart, 1874. Donor the author. 'Khiva and Turkestan.' From the Russian, by Captain H. Spalding. With Map. 1874. Donor the author. 'Voyage of the Venetian brothers, Nicolò and Antonio Zeno, to the Northern Seas, in the 14th Century.' Translated and edited by R. H. Major. 1873. Donors the Hakluyt Society. 'Un nuovo Porto a Napoli con un Dock.' Pel D. Cervati. Napoli, 1859. Donor, S. M. Drach, Esq. 'De l'Émigration des Chinois.' Par E. Madier de Montjan. Paris, 1873. Donor the author. 'Overland Journey from Lake George to Port Phillip in 1824.' By Hamilton Hume. Second edition. 1873. Donor the author.

ACCESSIONS TO THE MAP-ROOM SINCE THE LAST MEETING OF JANUARY 26TH, 1874.—Map of the River Thames, from its Source to London Bridge. By E. G. Ravenstein. Presented by J. Reynolds, Esq., F.R.G.S. Map of the River Thames, from London Bridge to Gravesend, with a Chart of the Thames Estuary, showing the Channels by gradation of colour. By J. Reynolds, F.R.G.S. Presented by the author. Four Maps of the Ashantee War. Presented by the War Office. Sketch Map of the Scene of Operations on the Gold Coast. Presented by E. Stanford, Esq. General Map of Switzerland. By General G. H. Dufour. On 4 Sheets. Presented by General Dufour. The Lake Regions of Eastern Africa, showing Livingstone's Routes. By K. Johnston. Presented by A. Johnston.

The PRESIDENT prefaced the business of the evening by stating that he had hoped to have been able to give the meeting some more conclusive intelligence than had been communicated at the last meeting regarding the fate of Dr. Livingstone, but the mail from India had not arrived, so that nothing further was yet known. There was still a ray of hope, which would not be obscured until the exact particulars were known.

The following paper was read :—

- 1.—*Notes of a Journey outside the Great Wall of China.* By S. W. BUSHELL, B.Sc., M.D., London University Scholar; Physician to H.B.M. Legation, Peking.

[ABRIDGMENT.]

ON September 2nd, 1872, the Hon. T. G. Grosvenor and the writer of these notes started together from the British Legation, Peking, on a trip through Inner Mongolia to Dolonnor, a large town founded by the Emperor Kang-hi, as a trading mart between the Chinese and the Mongolian tribes. About 25 miles north-west of Dolonnor are the ruins of the city of Shang-tu, the ancient northern capital of the Yuan dynasty, described in such glowing terms by Marco Polo, who was there in the reign of its founder, the famous Kublai Khan (A.D. 1280-94). Having explored these ruins, identified by the existence of a marble tablet with an inscription of the thirteenth century, we proceeded eastwards to the Muran Wei-chang, the imperial hunting-grounds of the reigning dynasty, thence to the city of Jehol, where Earl Macartney was received by the Emperor Chien-lung in 1793; and returned through the Ku-peï-kou Pass to Peking.

We left Peking early in the morning by one of the northern gates, and soon afterwards passed through a gap in the earthen rampart, which is all that remains of the old walls of Cambalu, which were 60 li (20 English miles) in circuit, and extended northwards and eastwards 5 li beyond the wall of the modern city. Thence the

road lay through the northern extension of the great alluvial plain in which Peking is situated, which is bounded on three sides by ranges of hills.

The Nan-kou Pass is 40 li long (3 li to the mile), from its commencement to the gates of the Inner Great Wall, which winds deep down into the valleys and over the tops of the hills of the Pa-ta-ling range. The floor of the pass is thickly strewn with masses of rock: formerly traversed by a limestone causeway, the huge fragments of which, uplifted and scattered by the force of the mountain torrent which rushes down in the rainy season, only serve now to increase the difficulties of the ascent. About 15 li from the entrance the limestone rocks are replaced by red coarsely-crystalline granite, and the pass contracts to a narrow defile bounded on either side by perpendicular cliffs. Here it is traversed by several walls and defended by fortresses built over the massive gateways through which the road passes. This is the historical pass of Chü-yung-kuan, so called, according to tradition, from the fact that Chin Shih-huang (B.C. 246-10) resided there when superintending the completion of the Great Wall. One of the gateways is spanned by a hexagonal marble arch, ornamented with Buddhist mythological figures carved in deep relief, with an inscription of the date 1345, a Buddhist invocation or dharani, in the characters of six different nations, Devanagari and Thibetan in horizontal lines, and below these Mongol, Ouigour, Niuchih, and Chinese in vertical lines. This arch was originally the basement story of a pagoda, which was pulled down, it is said, because the superstitious Mongols refused to pass underneath.

From Cha-tao, the small fortified town just beyond the inner Great Wall, to Kalgan, a distance of 260 li, our road followed the valley of the Yang River, passing through many walled towns and villages belonging to the prefecture of Hsuan-hua-fu. A range of hills bounds the valley on the northern side, covered sometimes to the height of several hundred feet by terraces of the "loess" deposit; the road runs along the foot of this range. At the fortress of Chi-ming-yi the road strikes the bank of the river, which here cuts through the range by a precipitous gorge, winding round the base of the rocky peak of Chi-ming-shan. The peak is crowned by a Buddhist temple at an elevation of about 2500 feet, approached by a steep winding path. It is composed mainly of coarse yellow limestone, burnt in many places for lime; on the northern side several seams of anthracite crop up to the surface, in which the openings of mines were visible from below. The road hugs the mountain side above the river, in some places cut deeply in the solid rock, till a

few li beyond the hamlet of Hsiang-shiu-pu, where it crosses a low range of sand-hills, and the large and important city of Hsuan-hua-fu breaks into view, in the midst of a fertile, well-watered plain, green with groves of poplar, willow, and sophora, interspersed with prolific fruit-orchards. The prefecture is generally celebrated for the abundance and excellence of its fruit: peaches, apricots, plums, pears, apples, cherries, persimmons (*Diospyros Schitse*), Shan-li-hung (*Crataegus pinnatifida*), melons, &c. &c., flourish, while grapes are widely cultivated, the vines trained over a wooden trellis-work in the Samarcand fashion. The principal natural productions, as detailed in the Chinese statistical works, are gold and silver, rock-crystal, chalcedony, and various kinds of agate, many variegated and ornamental varieties of building stone, white and coloured alums, and anthracite; leopard and bear-skins, wild goat and antelope; bear's gall, deer's horns, and musk—all three important remedies in the native pharmacopœia. Of the well-to-do population (a large fraction is Mahometan; the neat, well-kept mosque is a conspicuous feature in every city and large village, while the Mahometan inns are generally distinguished for their comparative cleanliness and comfort.

The capital city is surrounded by a wall, 8 miles in circuit, and includes some large handsome buildings with large parks, while lofty memorial arches span the main streets. It is mentioned by Marco Polo under the old name of "Sindachu," and is still famed, as in his day, for its woollen and felt manufactures. There is a considerable Roman Catholic community, for whose spiritual wants a cathedral is now in process of erection, on the grounds of the mission within the city.

Having left the city by the main northern gate, we passed through a long stretch of uncultivated ground, occupied by fine old trees, between which the ruins of extensive buildings appeared, half hidden by the tangled undergrowth: the site of a palace founded by the third emperor of the Yuan dynasty, called Chung-tu—the central imperial residence; abandoned, however, in the reign of his successor, who built instead a residence in the north-west of the department, and surrounded it with vast fruit-orchards.

The road proceeds northwards, striking the river just before entering Kalgan, and crossing it by a stone bridge of many arches, ornamented with carved grotesque figures of lions and tigers.

Chang-chia-kou, also called Kalgan, from a Mongol word "Kalga," meaning gate or barrier, is the frontier town, commanding one of the most important passes between China and Mongolia, and the main road of the overland route between China and Russia. There

is a walled fortress 4 li in circuit, but the merchants' houses, shops, and inns, form a long, straggling suburb, stretching from this, for some two or three miles, up to the gate of the Great Wall, which is strongly fortified and garrisoned. Just outside the gate one sees, on the right hand, a row of houses built in semi-European style, with large warehouses in the rear, belonging to the small community of Russian merchants, who send long caravans of camels, laden principally with brick-tea, over the Mongolian plateau to Urga and Kiakhta. From this spot radiate three passes, ascending to the edge of the plateau, distinguished as the western, central, and eastern roads, along each of which flows a small river, the three streams uniting at Kalgan to form the Ching-shui-ho. Following the western road, which runs parallel to the Great Wall, bending as it does at Kalgan abruptly towards the north-west, we traversed first a precipitous gorge through the range of trachytic porphyry hills, and then gradually climbed up the long uniform ascent, on a deep sandy and gravelly floor, between low square hills of metamorphic schists, often overlaid by more recent loamy deposits, worn by the action of water into perpendicular cliffs. In the faces of these cliffs are built in many places the dwellings—half caves, half mud-huts—peculiar to the “loess” formation of North China, sometimes in rows one above the other, like a huge pigeon-house. The sides of the hills on either side, where the slope is not too abrupt, are fringed with artificial terraces, and every available spot is under cultivation. Thirty li from Kalgan one passes a large aggregation of these huts, forming the village of Tu-cheng-tzu, and 10 li beyond this begins the sudden and difficult ascent up the precipitous face of the rocks which form the edge of the plateau.

Having surmounted this, the small village of Feng-kan-lu is soon reached. Here the Great Wall, which has hitherto followed the road in a more or less parallel direction, curves round towards the west. It consists of a mere heap of rubble, of rough unhewn fragments collected from the *débris* of the adjacent black volcanic rocks, and there are no traces of connecting mortar. Massive square towers, of solid brick with an earthen core, have been erected at intervals of two or three hundred feet, but they are now fast crumbling into ruin. This is known as the “Boundary Wall” by the Chinese, and was made probably during the twelfth century.

From the top of one of these towers, standing at an elevation of 5400 feet above the level of the sea, there is a magnificent and characteristic view. Stationed on the summit of the precipitous

cliff-like edge of the Mongolian plateau, and facing southwards, one looks down upon an expanse of low, flat-topped hills, weathering in white perpendicular facets, bounded by the volcanic Kalgan range, which hides from view the valley of Hsuan-hua-fu; while beyond, in the far distance, the sharp and rugged peaks of the granite range, along which runs the Inner Wall, pierce the clouds. On either side nothing but mountains, crowned by the square towers of the Boundary Wall; eastwards bending round towards the Tu-shih-kou Pass, westwards visible, range upon range, far into the province of Shansi, until they fade away in the blue distance. Towards the north the eye ranges over a prairie with long wavy undulations, the first of the grass-covered Mongolian steppes. On the fixed natural line of demarcation between a settled agricultural people and nomadic pastoral tribes, we were passing from a region of limestone, coal-measures, and granite, to one of tertiary and recent volcanic deposits; from the fertile, well-wooded valleys of Northern Chihli, rich in corn and fruit, to a "land of grass," the support of innumerable flocks and herds, where no tree is visible in a week's journey, and "argol," the dung of cattle, is the only fuel.

There is a corresponding difference in climate, and a cold, biting north-west wind reminded us feelingly of the wide variation of temperature a few hours' journey had brought about. There are some settlements of immigrant Chinese on the border of the plateau, as well as about the stations of the north-east trade routes, but they earn with difficulty a miserable subsistence by the cultivation of oats, rape, and potatoes, which have barely time to come to maturity during the short-lived summer. There is small prospect of encroachment in this quarter; further east, where the country is hilly and the valleys fertile, as well as in Manchuria, the Chinese agricultural settlers are numbered by the million, and the aborigines are being either pushed to the north or compelled themselves to become agriculturists.

Shipartai is the first station in Mongolia. It is a flourishing Chinese mart, situated in the midst of rich pastures, the source of the small river of Shipartai, which winds along towards the north-west to empty itself into the large lake Angoulinor. The settlement is surrounded by Mongol "yourts," belonging to the Chahar tribe. It is also a dépôt of bullock-carts—most primitive vehicles, made of a few rough planks with angular hexagonal wheels—which traverse the steppes in interminable trains, empty or laden with corn or manufactured goods, to return with crystals of nitre, salt, or impure carbonate of soda (natron), obtained by lixiviation from the soil of various parts of Mongolia.

The surrounding country is filled with lakes and pools of water, the haunts of innumerable flocks of waterfowl. We started with fresh ponies, and a Mongol lama as guide, to visit one of the largest lakes in the neighbourhood, the Ichinor, 60 li distant, and found the water black with waterfowl, which rose in dense flocks and filled the air with discordant noises. Swans, geese, and ducks, predominated, and three different species of cranes were distinguished, but it was impossible to get within shooting range, from the total absence of cover. The lake is about three miles in circumference. Ten li to the south the ground gradually rises, forming a smooth, grassy elevation, raised a few hundred feet above the general level of the plateau. This is the Tengri Obo, one of the most sacred hills at which the Mongols worship. It is crowned by a cairn of stones, heaped up around a central pole, and hung about with strips of silk and cotton, a relic of ancient nature-worship. On one side of the cairn a wretched wooden box was placed, enclosing a porcelain image of Buddha, a curious example of the incorporation of ancient superstition into a more modern form of worship. It was odd to observe our priest's looks of unutterable horror when one of us unwittingly offended by climbing to the top of the cairn to get a better view of the country; he afterwards made not a few propitiatory kotows.

The surrounding country is interesting from historical association, and there are many ruined towns in the vicinity. Forty-five li to the west the lake Chagannor was visible, and on the bank the ruins of Chagan Balgasun, now known by the Chinese name of Pai-cheng-tzu, *i.e.* White City. This was founded by Kublai Khan; it was visited and described by Marco Polo. The emperor was in the habit of staying here some days during his journeys to and fro from Cambalu to Shangtu; he kept a number of falcons in mew, and made hawking excursions to the many lakes in the vicinity.

From Tengri Obo we rode south-westwards through the pasture-land allotted for the breeding of horses, to the Yellow Manchu Banner, and after 40 li, arrived at the ruins of a once famous city, the Hsing-ho-cheng,\* founded during the Liao dynasty (A.D. 907-1125), and the chief city of a "lu" circuit under the Yuan. The walls are 6 li in circumference, with the remains of four gates; it is completely deserted and overgrown with grass. The adjoining district is occupied by a small agricultural settlement of Chinese immigrants from the province of Shansi. Near the ruins flows the small river Bourgastai, and on the opposite bank of the river is

\* Known also by the Mongol name Kara Hotun.

the hamlet of Urtai, a station on the Russian caravan route. From Urtai to Shipartai is 50 li, over monotonous steppes, on the distant ridges of which a few antelopes are occasionally seen.

From Shipartai to Changmatz'ching, a distance of 130 li, the road follows the Dolonnor trade-route, and there are large bullock-cart depôts at frequent intervals. The only place worthy of note is Panshanlu, where there is a military station and a Buddhist temple. Towards the end the country becomes more hilly, and antelopes abound, in herds sometimes of several hundreds.

Thence to Dolonnor is 250 li. Two rivers have to be forded—first a small stream, flowing westwards to empty itself into the Kere Lake; afterwards the River Shangtu, so called from the old city on its left bank; it becomes the Lan-ho in its lower course. Here it is a sluggish stream, about 10 feet wide, and easily fordable, winding through a marshy tract. There is a Chinese village on the left bank, with two good inns. After crossing this we came upon another smaller stream at Hapachiao, pursuing a winding course through a rich pastoral country towards a small lake. We kept in the valley of this, the Harapoulac River, crossing and re-crossing its bed, leaving it finally at Chapeng, a caravanserai 30 li from Dolonnor. The banks were dotted with Mongol encampments, at several of which we rested awhile, always most hospitably received, and given a cup of hot milk out of the caldron which occupies the centre of every tent, with occasionally a pat of fresh butter added.

The general elevation of the plateau above the sea is nearly uniform, averaging 4500 feet, which is the altitude of Shipartai, while at Dolonnor it is 4300 feet.

\* Towards Dolonnor the ground becomes barren and sandy, and the loose sand is collected by the wind into moving hillocks, which enclose and separate a chain of lakes, from which the town derives its name (Dolon-nor being in Mongol "Seven Lakes"). The road winds round and between these small lakes, until suddenly a pagoda is seen ahead in a gap between two sandhills, and soon after a large and populous town breaks into full view.

Dolonnor, commonly known by the Chinese name Lama Miao, from the large temples in its vicinity, was founded by the Emperor Kang-hi after the successful termination of his expedition against the Mongolian Prince Galdan, chief of the Eleuth tribes. It is now a flourishing town, with a trading population estimated at about 20,000, almost exclusively Chinese. A few handsome official residences, and one or two temples and pagodas, relieve the dull uniformity of the brick and mud shops and houses, closely packed together, and separated by narrow, dirty, and undrained streets.

It differs from Chinese towns in the absence of the usual battlemented wall, being surrounded only by an earthen wall connecting the outer houses, enclosing a space of about a square mile, and having tall wooden gates at the ends of the principal streets, which are locked at nightfall. Dolonnor was visited by the Abbé Huc during his celebrated journey from the Roman Catholic station at the "Valley of Black Waters" to the capital of Thibet. It is famed for its numerous manufactories of bells, idols, and the multitudinous bronze paraphernalia employed in the Lama religious ceremonies, and of the smaller figures, talismans, and gaudily painted figures to be found in every Mongol tent. The silversmiths display in tempting profusion the elaborate silver trappings and earrings, laden with coral, turquoise, lapis lazuli, and jade, with which the Mongol women love to adorn their coarse tresses, as well as necklets, bracelets, and rings, for which they exact the most extortionate prices. Other shops are filled with guns, pistols and swords, with saddles, bridles, and gay trappings, and the manifold products of Chinese civilisation, for which the Mongols barter their horses, bullocks, and sheep, and the various spoils of the chase.

Dolonnor is situated within the northern bend of the Shangtu River,\* which is 40 li distant to the north, 30 li to the east.

On the third day after our arrival we rode to visit the ruins of the ancient Mongolian capital of Shangtu, situated 80 li to the north-west of Dolonnor, now known by the Mongol name of Chao naiman soumé Hotun—"the city of a hundred and eight temples." The road passed first over a series of low sandhills, then crossed a steep range of volcanic hills, descending into a wide rolling prairie, covered with long grass and fragrant shrubs, the haunt of numerous herds of antelope. This prairie gradually slopes down to the marshy bed of the river, here a considerable stream 20 feet wide; in former times flat-bottomed grain-junks ascended from the sea to this point, bringing up supplies of rice from the southern provinces for the use of the city and court. Now the only building in the neighbourhood is a small Lama monastery, the abode of some six or seven wretched priests, while a few scattered tents belonging to the Chahar tribe stand on the river-banks. The city has been deserted for centuries, and the site is overgrown with rank weeds and grass, the abode of foxes and owls, which prey on the numerous prairie-rats and partridges. The ground is but slightly raised above the bed of the

\* In all the maps that I have had an opportunity of consulting, Dolonnor is wrongly placed on the north bank of the river, it having been presumed, I opine, that it was built on the site of the city of Shangtu, which is really more than 25 miles distant.

river, which flows past the south-east at a distance of 4 or 5 li from the city wall, while it is overshadowed on the opposite side by the Hingan range of mountains, trending south-west, north-east, and rising into lofty peaks farther north. The walls of the city, built of earth, faced with unhewn stone and brick, are still standing, but are more or less dilapidated. They form a double enceinte, the outer a square of about 16 li with six gates—a central, northern, and southern, and two in each of the side walls; while the inner wall is about 8 li in circuit, with only three gates—in the northern, eastern, and western faces. The south gate of the inner city is still intact, a perfect arch 20 feet high, 12 feet wide. There is no gate in the opposite northern wall, its place being occupied by a large square earthen fort, faced with brick; this is crowned with an obo or cairn, covered with the usual ragged streamers of silk and cotton tied to sticks, an emblem of the superstitious regard which the Mongols of the present day have for the place, as evidenced also by the modern legendary name—"the city of 108 temples." The ground in the interior of both inclosures is strewn with blocks of marble and other remains of large temples and palaces, the outline of the foundations of some of which can yet be traced; while broken lions, dragons, and the remains of other carved monuments, lie about in every direction, half-hidden by the thick and tangled overgrowth. Scarcely one stone remains above another, and a more complete state of ruin and desolation could hardly be imagined, but at the same time everything testifies to the former existence of a populous and flourishing city. A broken memorial tablet was found, lying within the north-east angle of the outer city amid many other relics, on a raised piece of ground, the site evidently of a large temple. The upper portion, projecting above the surface of the ground, contained an inscription of the Yuan dynasty, in an ancient form of the Chinese character, surrounded by a border of dragons boldly carved in deep relief. This tablet was erected by the Emperor Shih-tsü (Kublai Khan), the founder of the Yuan dynasty, in memory of a Buddhist chief-priest of high rank, head of the monastery. The lower half of the massive marble slab lies doubtless buried beneath the grass, but we were unable to get at it for want of proper tools.

Outside the city proper, as described above, there is yet a third wall, smaller than either of the others, but continuous with the south and east sides of the outer city wall. This is now a mere grassy mound, enclosing an area estimated at 5 square miles, to the north and west of the city. This must be the park described by Marco Polo, inside which were "fountains, and rivers, and brooks,

and beautiful meadows, with all kinds of wild animals, which the emperor has procured and placed there to supply food for his ger-falcons and hawks which he keeps there in mew. The khan himself goes every week to see his birds sitting in mew, and sometimes he rides through the park with a leopard behind him on his horse's croup; and then if he sees any animal that takes his fancy, he slips his leopard at it, and the game when taken is made over to feed the hawks in mew." \*

The city of Shangtu is referred to by Coleridge in his 'Dream of Kublai's Paradise' :—

" In Xanadu did Kubla Khan  
 A stately pleasure dome decree :  
 Where Alph, the sacred river, ran,  
 By caverns measureless to man,  
 Down to a sunless sea.  
 So twice five miles of fertile ground  
 With walls and towers were girdled round :  
 And there were gardens bright with sinuous rills,  
 Where blossomed many an incense-bearing tree;  
 And here were forests, ancient as the hills,  
 Enfolding sunny spots of greenery."

Widely different, however, is the condition of the country in the present day. All around is dreariness and desolation. Even the natives were rude and inhospitable—the rarest case among the Mongols. The gates of the small monastery, where we had hoped to pass the night, were barred at our approach, and the priests on the other side obstinately deaf to arguments or bribes. Late as it was, we were perforce compelled to remount our ponies and gallop back as fast as they would carry us over the twenty-seven miles of hill and dale which separated us from Dolonnor.

The following day, September 17th, we devoted to the examination of the magnificent Lama temples and monasteries situated in the plain about a mile north-west of Dolonnor. The larger of the two, the Hui-tsung-ssu, was built in the reign of Kang-hi by contributions from the Mongol tribes. The emperor bestowed a name upon it in the 30th year of his reign (A.D. 1694), having erected at the same time in one of the principal courts a marble monumental tablet, inscribed in the characters of three languages—Manchu, Mongol, and Chinese—with verses commemorating his victories. The other temple is about a li distant towards the south-west; it was completed in the 7th year of Yung-cheng (1729), called by the emperor Shan-ying-ssu, and presented with a similar monument, having also a tri-lingual inscription. The temples are

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\* Colonel Yule's 'Marco Polo,' ch. lxi.]

both surrounded by monasteries, long parallel lines of brick dwellings, enclosed by a low wall, in which the Lama priests live, in number amounting altogether to nearly three thousand. They are an ignorant, lazy, illiterate class, and collected round the strange visitors in crowds, open-mouthed and staring. The wide square faces, with projecting jaws, large mouths, and small porcine eyes, the foreheads low and receding, and the small bullet-like shaven skulls, were curious studies, exaggerating the more repulsive features of the Mongolian type. The vacuous, semi-idiotic expression of many—the large admixture of the maimed, halt, and hump-backed—the occurrence of faces deeply scarred and eyes destroyed from the ravages of small-pox, and of noses eaten away by caries—all combined to show that it is not the most intelligent of their sons, nor those without blemish or spot, whom the Mongols devote to the service of Buddha. The temples, on the contrary, are truly gorgeous and well appointed, with lofty halls supported by pillars in the ordinary style of Chinese architecture, and interiors richly decorated with vermillion and gold. Thibetan scrolls are engrossed on the walls and roof and cover the rich silk hangings and tapestry, and the Sanscrit characters of the mystic formula, "Ommané padmé oum," meet one at every turn. The huge images and prayer-machines, the yellow robes and Grecian helmets of the officiating priests, the musical instruments of the band, and all the paraphernalia of the Lama ceremonial, have been often described, and may be seen any day at the Great Lamassery of Peking. The reigning dynasty of China has always favoured its development, from the powerful hold it gives them over the superstitious Mongols. In few countries are the outward evidences of religion so universally apparent. Even the "heathen Chinee" of these parts palms off his sham jewellery, wrapped up in paper, inscribed "Ommané padmé oum," and prefaces his most exorbitant hotel bill with the same comforting formula.

From Dolonnor we journeyed eastwards, riding over a grassy plain till we came to the ridge of sandhills which separates the plain from the river valley. The river here averages 30 feet in width, still shallow and sluggish. We forded it at the hamlet of Ta-ku-shan. Twenty li farther on we traversed a pass in the volcanic range which forms a portion of the western boundary of the imperial hunting-grounds, and entered upon a wide uncultivated prairie, studded with patches of dwarf willow and elm, the feeding-ground of many herds of antelope. Having crossed this we struck the right bank of the Hsiao Lan River, and put up for the night at a large stockaded house.

The next day's journey was more than 40 miles, all through the hunting-grounds, during the whole of which not a single house was seen. After crossing the small river the country became gradually more and more broken till we came to another range of mountains trending north and south; the crest of this range, elevated nearly 5000 feet above the sea, we reached after a long gentle ascent, and descended by a winding rocky path the opposite face, steep and precipitous. From this point there is a most complete change in the scenery and general aspect of the country. The monotonous undulating plateau, sandy or covered with short herbage, treeless and barren, is replaced by a broken hilly district, the mountains green to their summits with abundant vegetation, clothed with an undergrowth of hazel-nut, wild rose, wurana (*oulana*), and other berried shrubs, and fragrant with artemisia, the shady recesses filled with clumps of elm, birch, maple, pine, and oak, while the numerous valleys of rich peaty soil are occupied by deeply-winding streams, and support a thick tangled growth of grass and legumes, two to three feet high, with groves of willow and poplar at frequent intervals.

This brief description may serve to give an idea of the nature of the country chosen and marked out by the Emperor Kang-hi, the second of the reigning dynasty, to be guarded and preserved for the autumn hunting expedition, which started annually from the summer palace at Jehol. Having ridden down several gently sloping and tortuous river valleys, we arrived at last late at night at the stockaded station, called Manitu Kalun, one of the Manchu guard-houses of the centre of the southern boundary of the hunting-grounds, situated at the head of the valley of the Yimatu River. There were stationed here a petty officer and four private soldiers of the Bordered White Manchu Banner. After a long parley they were induced to unbar the massive timber gates, and finally ensconced us in the best part of the house. We were most hospitably entertained for two days by the sergeant, a fine-looking veteran, who took great pride in a set of unusually large tiger's claws, the relics of an ancient adventure, which he wore at his girdle. He was even complacent enough to tell off one of his men to act as our guide on a shooting excursion.

The imperial hunting-grounds, styled the Muran Wei-chang—"muran" signifying deer-hunting in Manchu, "wei-chang" hunting-grounds in Chinese—are described in the Chinese statistical works as lying outside the northern boundary of the prefecture of Cheng-te-fu (Jehol). They are surrounded by the territory of Mongolian tribes, having the Kalachin Banners on the east, the

Chahar Banners on the west, the Parin and Koshikhkoteng Banners on the north; bounded south-east by the Kalachin, south-west by the Chahar Blue and Bordered White Banners, north-east by the Ongniout, and north-west by the Chahar Blue Banner. The circumference is more than 1300 li, the diameter from east to west being over 300 li, from north to south over 200 li. The territory originally belonged to the Kalachin Aohan and Ongniout tribes, and was handed over by them to the Emperor Kang-hi during one of his autumn expeditions outside the Great Wall. The boundaries were then fixed, and willow stakes were afterwards set up to mark off the ground as sacred, while a decree was issued threatening severe punishments on any Manchu, Mongol, or Chinese who should thereafter be discovered hunting or shooting within the precincts. The grounds are guarded by a detachment from each of the eight Manchu Banners, which watches a certain portion of the boundary line. Each detachment is divided into five sub-divisions, and occupies five kalun or guard-houses, so that there are in all forty kalun, situated in the river valleys and mountain passes, the channels of communication with the surrounding country.

The whole district is mountainous, the mountains increasing in height towards the north-west, where they merge into the Hingan range, which is described as of unknown breadth and extent, with peaks stretching far into the clouds, and as clothed for some distance from the base with trackless forests. The hunting-grounds give rise to an immense number of rivulets and streams, which may be collected into two groups—the one flowing southwards towards the Shangtu or Lan River, the other north-eastwards towards the Sirgai River, an affluent of the Siramuren.

During the reigns of Kang-hi and his immediate successors, an annual expedition was organised at the palace of Jehol, after the expiration of the hot summer months, in which the emperor was accompanied by his whole court, a long train of princes and mandarins, and an army of soldiers. The purpose of the expedition was to train and exercise the army in military manœuvres, more than purely for hunting. The princes of the neighbouring Mongolian tribes were also required to be in attendance, and to bring with them some thousands of mounted followers to assist in the grand battue. At the same time they were to be impressed with the military power of China, so as to be convinced of the uselessness of rebellion against the power of the emperor.

At the town of Huang-ku-tun (Poro Hotun), 120 li from Jehol, the road to the Wei-chang branches into two. The eastern road was the one usually taken, following the valley of the Yisun River,

and entering the grounds just beyond Shih-pien-tzu, a village 90 li beyond Huang-ku-tun. The Wei-chang is divided into sixty-seven smaller hunting-grounds, each one a plain at the source of one of the many smaller rivulets, distant from 2 or 3 to 50 li from each other, and named usually after the particular stream which flows from its borders. Having entered the hunting-grounds, the imperial party proceeded in its tortuous course from one to the other of these plains, halting at each while the many horsemen and foot-soldiers, formed into a huge ring enclosing mountain and valley, gradually converged, driving before them the game towards the place selected, where it was brought down by the spears and arrows of the emperor and his courtiers. The circuit completed—a task of at least a month—they emerged from the grounds at Pan-chieh-ta, distant 180 li from Huang-ku-tun, by the valley of the Yimatu River. After the reign of Chien-lung the expedition began to be made only at irregular intervals, and since the time of his successor Chia-ching, who died in 1820 on his return from hunting, no emperor has undertaken the journey. The Emperor Chien-lung built a succession of "travelling palaces" along the whole route, from the Great Wall at Ku-pei-kou to the two entrances into the grounds, at distances from each other of about 60 li—an easy day's journey. They are situated in picturesque spots on the sides of the hills, embosomed in groves of fir, and consist of a series of halls and open courtyards, with a shady arbour on the hill behind, in addition to side buildings and barracks in front for the guard. Of late years they have been sadly neglected, and they are now fast falling into ruin.

After a short stay we left our comfortable quarters at the Manitu station with much regret, and followed a south-easterly valley for a few li, till we reached a square brick round-topped tower, called Pan-chieh-ta. This marks the limit of the Wei-chang in this direction, and at this point begins the large and rich prefecture of Cheng-te-fu, which extends southward to the Great Wall, eastward to the Palisade boundary of Manchuria. We proceeded down the valley of the Yimatu River, a populous agricultural district, varying in breadth from a few hundred yards to more than a mile, bounded on either side by lofty hills of secondary limestone and coarse conglomerate. Towards the end of the second day we left the valley, crossed the eastern range of hills, and descended upon the important and picturesque town of Huang-ku-tun, formerly known by its Mongol name of Poro Hotun. This occupies the valley of the Yisun River, the houses clustering about the left bank and swarming up the hill-side, with one of the imperial hunting-boxes, surrounded by groves of pine and larch, in the background. It is

situated at the point of junction of the two main roads from the hunting-grounds.

The river valleys of this district are densely populated by Chinese immigrants, and flourishing well-built villages, each with its Buddhist temple, two or three inns, and comfortable tiled cottages, occur at intervals of a few li. The ground is fertile and well cultivated, often channelled for artificial irrigation, while the steep hills are terraced to the height of several hundred feet. Rice, wheat, barley, maize, and buckwheat, the various kinds of millet, and other cereals; the many varieties of pulse; linseed, hemp, castor-oil, and other oil-producing seeds; tobacco and the opium-poppy, the yam or sweet potato; in short, all the plants cultivated in the plain of North China, flourish abundantly. The castor-oil plant, which usually borders the roads and pathways, grows often to the height of 10 feet, indicating the fertility of the soil.

The aboriginal Mongolian tribes of this part of the country have been altogether expelled. Farther north they are being yearly pushed back more and more by the rapidly encroaching peasant hordes. Eastward in the district of Pa-kou the Mongols themselves have taken to agriculture, and build permanent villages of small hive-like mud huts, modelled after the form of their old felt tents. In these river valleys, on the other hand, not a single Mongol remains, where two centuries ago the land belonged to them exclusively. The rivers, hills, and natural features of the country all retain their original names, though often disguised by the vile Chinese pronunciation. The common name "Shipartai," for instance, meaning originally "plain meadow-land," has become, both in the spoken and written tongue, "Shih-pa-li-tai," which signifies "eighteen li terrace;" and if you ask a Chinaman the derivation thereof, he will certainly tell you, "Why, of course, because it is 18 li from Huang-ku-tun."

After leaving Huang-ku-tun we followed the road which leads to the valley of the little river of Shipartai, and kept parallel to the river till we arrived at the large village of Chung-kuan. From this point we proceeded down the picturesque valley of the Je-ho—"the hot river"—which takes its name from the numerous hot springs from which it derives its source, till we reached the city of Cheng-te-fu, the capital of the department.

This department was founded and its divisions and boundaries established in the reign of the Emperor Kang-hi. It was originally divided into five "ting :" Je-ho-ting in the centre, Kara Hotun-ting to the south-west, Ssu-chi-ting to the north-west, Pa-kou-ting to the east, and Tatzu-kou-ting to the east of the last. Afterwards a

separate district was made out of the northern portion of Pa-kou-ting, and styled Wulan Hata-ting, while the eastern part of Tatzukou-ting was cut off to form San-tso-ta-ting.

In the 43rd year of Chien-lung (A.D. 1778), the system was remodelled and assimilated to that of the Chinese provinces, the names being changed to those which they still have. Je-ho-ting was elevated to the rank of chief city of a prefecture, styled Cheng-te-fu, including within its bounds the remaining six, of which Pa-kou-ting was made a city of the second order, and called Ping-chuan-chou; the other five cities of the third order, and their names changed to Lan-ping-hien, Feng-ning-hien, Chih-feng-hien, Chien-chang-hien, and Chao-yang-hien. The prefecture forms part of the province of Chih-li. These changes were made nearly a century since, but the obsolete names are still retained in our maps.

The immigrant Chinese, coming mainly from the three provinces of Shansi, Shantung, and Chih-li, push on year by year up the fertile river valleys. The larger carnivora, the deer and antelope, are being driven to the mountains and gradually exterminated, and the Mongols deprived of their favourite hunting-grounds.

In addition to the crops mentioned on a former page, the indigo-plant and silkworm mulberry are largely cultivated towards the south, and Ping'-chuan-chou is specially famed for the excellence of its silk manufactures, produced from the silk of the worm which feeds on the leaves of the wild "Po-lo-shu," the *Quercus cerasifera*, Bge.

The approach to the city of Cheng-te-fu from the north, by the winding valley of the Je-ho, is most effective and picturesque. Emerging from the gorge through the bold precipitous hills, which weather into the most grotesque forms, with huge oblong masses of conglomerate supported by a needle-point on the apex of a crag, or overhanging the brink of a precipice, one comes suddenly upon a beautiful scene. The valley in front widens out and branches off into several smaller transverse gullies, between round-topped gravel hills, covered with pine and elm, enclosing some scores of Lama monasteries and temples, which meet the view in every direction; to the right the long wall of the imperial palace winds over hill and valley, enclosing lofty well-wooded peaks, on the tops of which are perched small arbours; while below and in front, at some distance, are seen the straggling houses of the large unwalled city filling the narrowing end of the valley.

The largest and most important of the Lama temples is the Putala-ssu, built in a peculiar and striking style of architecture, on

the model, it is said, of the palace of the Grand Lama of Thibet at Putala, in the neighbourhood of Lassa. The principal building of this temple is a huge square erection, with eleven rows of windows, the storeys coloured alternately red, green, and yellow, surmounted by a row of five gilt dagobas, and with the roof covered with enamelled tiles of a bright turquoise-blue colour. The general effect is inexpressibly *bizarre*; but the whole is an elaborate sham, the windows are mostly false, and the building a mere shell, enclosing and concealing a hall with the roof supported by wooden pillars in the ordinary style of Chinese architecture. This is described in Staunton's 'Account of Macartney's Embassy,' and there is a fair representation of the external aspect in the accompanying 'Atlas.' The next largest temple is a similar imitation of the Palace of Teshu Lhumbo, the residence of the Teshu Lama of Thibet. The numerous other temples on the hill-sides and in the adjacent valleys do not call for a detailed description.

Having struck the palace-wall, one rides along it for about a mile on the solid stone causeway raised above the bed of an old lake, and arrives at the city after crossing a substantial stone bridge. The palace, called the "Pi-shu-shan-chuang," the "mountain-lodge for avoiding heat," was constructed in the year 1703, on the plan of the Summer Palace of Yuan-ming-yuan, near Peking. It is surrounded by a substantial brick wall more than six miles in extent, running along the summit of the range of hills which encircles the valley towards the west and north. This wall encloses the many halls and pavilions, the temples and pagodas, the gardens and rockeries, which constitute the typical Chinese palace. It was in the interior of this that Earl Macartney was admitted to an audience by the Emperor Chien-lung, in 1793, "in a spacious and magnificent tent supported by gilded, or painted and varnished, pillars."

The city of Cheng-te-fu or Jehol consists of one long tortuous main street, extending for some two miles from the river-bank, with many smaller streets jutting out at right angles. The official yamens, temples, inns, shops and private houses are precisely similar to those of a flourishing Chinese city of the same rank, but, like other Mongolian cities, it is not surrounded by a wall. It is noted for the manufacture of a peculiar kind of inlaid mosaic work; and large quantities of boxes, tables, and other furniture, in which the walnut, elm, and variously coloured woods abounding in the surrounding country are worked into intricate patterns, are made here for exportation. The population is almost exclusively Chinese, with the exception of the large community, to be numbered by the thousand, of the priests of the Lama temples and monasteries, who

are generally either of Mongolian or Thibetan extraction. The citizens collected in crowds to attend the strange men from the West in their walks through the streets, and unwelcome shouts of "foreign devils" were raised by the rabble on the outskirts of the crowd, but the more respectable people at once checked all hostile demonstration on being appealed to. A Chinese mob is troublesome from its insatiable curiosity, following one into shops, and particularly fond of examining the texture of one's clothes, speculating wildly on the original cost thereof; all of which would not be so unendurable, were it not for the overpowering fumes of the garlic with which it is always saturated. It is, as a rule, peaceable, and even when otherwise disposed it is peculiarly susceptible to a seasonable joke or an appropriate touch of satire, which the bystanders will appreciate, even if the victim does not.

The road to Lan-ping-hien, which is only 40 li from Jehol, follows first the south wall of the palace, and then ascends the steep and rocky side of the ridge of Kuang-jen-ling, "the peak of broad benevolence," so named, as commemorated by the inscription on a marble tablet on the top, by the Emperor Kang-hi, after the road had been made by him at vast expense, the rocks, of hard coarse conglomerate, having been chiselled in some places to the depth of several feet. The descent on the opposite face is no less steep; after accomplishing which we rode for some miles over an undulating agricultural country, till we came again to the Lan-ho, the same river which was so often forded about Dolonnor. Here it is much wider and more rapid, and we had some difficulty in fording it to cross to the town of Lan-ping-hien, situated on the right bank of the river. This is also an unwalled city, of the third rank, the capital of an agricultural district; it was formerly known by the Mongol name of Kara Hotun, which is totally unfamiliar to the natives of the present day. The city is dull and uninteresting, the only picturesque point being an Imperial travelling palace, with its usual halls and pavilions, environed by a thick grove of trees, on the side of the hill across the river.

From Lan-ping-hien to Ku-pei-kou is a distance of 100 li by the most direct route. The road passes through valleys and over several ranges of hills, but on the whole gradually descends. The most difficult pass is about 10 li beyond the village of Ma-chuan-tzu, where the road ascends to the top of a ridge of more than 2000 feet, surmounting one after another the "eighteen platforms" thereof, and descends on the opposite face, along the rough bed of a mountain torrent, of the steepest and most difficult description, filled with huge boulders of granite, limestone, and conglomerate heaped one

above the other. This excels even the Nankou Pass in roughness, and, as in that, the remains of a stone causeway are mingled confusedly with the débris of the overhanging cliffs, and only a few of the more solid bridges across transverse torrents yet remain in tolerable preservation.

The road soon became easier, and we passed into one of the frequented trade-routes, meeting and overtaking many large caravans. The principal cargo appeared to be wood, previously sawn into beams and planks, and carried southwards by powerful camels. The approach to Ku-pei-kou on this side is by a broad, level, and sandy river-valley, crossed by the Great Wall. The Wall here has been well described, and plans and sections given, in Staunton's book quoted above.

Branches jut out in all directions, reaching to the various summits of the basin of hills, deep down in the centre of which lies the walled and fortified town of Ku-pei-kou, with a wide, sluggish river winding along close under its walls, towards the precipitous gorge by which it finds its way into the great plain of China. It is a bustling commercial mart, but chiefly famous, at least according to our notions, for its delicious fragrant honey, produced by the wild bees which swarm in the mountains surrounding the Tungling. On the heights to the south of Ku-pei-kou a large garrison is stationed; and here is the last line of fortification, through the massive stone gateway of which, rejoicing in the name of "the gate of the southern paradise," we had to pass.

Having forded the river, which flows just beneath these heights, we made all speed to get over the 240 li of familiar and uninteresting country which separated us from Peking—an arable district, with many walled cities and villages. We reached one of the western gates of the celestial capital on the afternoon of the second day, both ourselves and our ponies well pleased to arrive at comfortable quarters after one month's constant travelling.

The Paper will be printed *in extenso*, with Maps, in the 'Journal.'

Sir RUTHERFORD ALCOCK said the next paper was an attempt by Mr. Phillips, a member of Her Majesty's Consular Service in China, to trace part of the route of Marco Polo, and to identify some localities mentioned by him which had been erroneously laid down in late editions of that author's travels. Notwithstanding the great erudition and critical power and talent of Colonel Yule, who had published the best edition of Marco Polo's work, it was still almost impossible to identify many of the places which the Venetian had visited. Mediaeval geography contained an enormous mine of wealth, but it could not be worked into currency for practical purposes for want of some laborious explorer who would follow in Polo's tracks. Marco Polo had traversed the whole of the vast continent of Asia, but the only method he and other mediaeval geographers could follow in marking the discoveries they made, was that of

stating the number of days' journeys one place was from certain other places; generally towards the rising sun or towards the south. In crossing the deserts or rivers Marco Polo's time was very irregular, and the calculation of his journeys was so uncertain, that the best and most learned German geographers, when they endeavoured to map his marvellous account of his journeys, were misled to the extent of carrying the east of Asia right across the Pacific to the longitude in which Columbus stumbled upon America when he was looking for Japan. This showed that without the aid of scientific instruments all geographical exploration must be exceedingly vague, and of little value. Until European travellers, with scientific means of fixing distances and latitudes and longitudes, followed in their track, the information contained in the works of mediæval geographers who traversed many regions still unknown, would be useless. Mr. Phillips and Dr. Bushell had contributed in some degree to the elucidation of these points, and it was a subject of congratulation that the members of the consular, the diplomatic, and the mercantile services, should be willing to devote their leisure to such useful, though unbrilliant, efforts in order to perfect our knowledge of the geography of those regions.

The following paper was then read by Mr. Holt:—

2.—*Notices of Southern Mangi.* By GEORGE PHILLIPS, H.M. Consular Service, China.

[ABRIDGMENT.]

DURING the past ten years two editions of Marco Polo's Travels have been given to the public—one by M. Pauthier, a great Chinese savant, the other by Colonel Yule, a great Oriental scholar. Both of these editions are full of the most varied Oriental learning and most recondite notes, reflecting the highest credit upon the industry and attainments of their respective editors, and leaving nothing, it would seem, for future critics to comment upon. There is, however, one part of the book that has not met with such accurate commentary as it deserves: I allude to that part which treats of the cities of the southern division of Mangi, passed through by our traveller on the way to his port of embarkation, Zayton, which cities have nearly all been erroneously identified. I purpose, therefore, in a few short notes to bring forward my arguments in support of what I consider the correct identification of the particular places in question, which I feel I am justified in doing from the fact of having personally gone over the greater part of this ground described by our great mediaeval traveller, and also from the fact of having for a long time past made the history of the localities in question my especial study.

For the cause in hand, I will take up our traveller's history at Que-lin-fu, which can, I think, without fear of contradiction, be identified with the present city of Kien-ning-fu. After three days' journey from this city of Que-lin-fu (Kien-ning-fu), our traveller

informs us that he reached a city called Unguen, or Unken, where there is an immense quantity of sugar made. This Unguen or Unken I identify with the present city of Yung-chun-chow, locally called Eng-cheng. The distance from Kien-ning-fu to Yung-chun-chow is 300 Chinese li, a space easily travelled over in three days, which agrees with the time occupied by Marco Polo in passing from Que-lin-fu to Unguen. The resemblance in sound between Eng-cheng and Unguen is also very near. Sugar is largely grown in the neighbourhood.

Fifteen miles farther from this city of Unguen, mention is made of a city called by Ramusio in his edition of our traveller's work, Kangin, and in almost all others, Fuju.

Fuju has been the reading accepted by most commentators, and from its great resemblance in sound to Fouchow, has been identified with that city. From the accepting of this reading as the correct one, and the ignoring of Ramusio's reading, Pauthier, in his edition of Marco Polo, has fallen into some amusing errors, altering, in one case, the course of the Fouchow River to suit his particular views, concerning which he gravely informs us that this river (the Min) does not flow by Fouchow now as it did in Marco Polo's day; while, unfortunately for his theory, a magnificent bridge, first erected long before Marco Polo's time, spanned then, as now, the river at Fouchow, connecting its northern and southern shores.

I am in favour of Ramusio's reading, and consider his Kangin to be the correct one, and have no hesitation in identifying it with the city of Chuan-chow-fu, locally called Choan-chin, and commonly known among Europeans as Chinchew. There is sufficient resemblance in sound between Kangin and Choan-chin, to justify us in considering it one and the same place; but, apart from this, I will, from internal evidence, taken from the various descriptions of the place, prove that this Kangin, otherwise Fuju, cannot possibly have been Fouchow.

For example, in some editions mention is made of Fuju being the capital of the kingdom called Chouka. By this Chouka, Fookien appears to be meant. Now, Fouchow or Fuju was not the capital of Fookien in Marco Polo's time, but Choan-chin was. Further, "many vessels arrive at this port from India, freighted by merchants, who bring with them rich assortments of jewels and pearls, upon the sale of which they obtain a considerable profit."

This statement alone destroys all claims that may be brought forward in support of Fouchow being considered the Kangin or Fuju of Marco Polo; for ships from India did not frequent Fouchow

in Marco Polo's time, nor was there ever any foreign trade carried on there till the commencement of the 18th century.

The only ports in Fookien carrying on trade with foreign countries in Marco Polo's day, were Choan-chin and Geh-kong, of which latter place more anon.

After five days' journey from Kangin, our traveller arrived at the noble and handsome city of Zaitun, which has a port on the sea-coast celebrated for the resort of shipping loaded with merchandise, which is afterwards distributed through every part of the province of Maigi.

Klaproth identifies Zaitun with Tszü-teng, an ancient name of Choan-chin.

I cannot accept this theory, feasible as it may appear.

Fortunately for us, in the edition of Marco Polo published by the Geographical Society of Paris, there is a list given of the various readings of places as found in other editions, and among the names given to Zayton, we find Carcon, Caykong, Sarcam, and Tarcam.

These several editions of Marco Polo are not singular in giving other readings of this name Zayton.

In D'Herbelot's 'Bibliothèque Orientale' we are informed that it is a maritime town of China, also called Scherkham by the Arabs, and, more curious still, Strengin by the Chinese.

Friar Oderic makes mention of the place under the names of Carchan, Caiton, and Zaiton, and speaks of it as a city twice as large as Bologna.

With such readings of the place as Caykong, Carcam, Carchan, and Scherkham, I am enabled to fix with almost positive certainty the locality here indicated.

During the Middle Ages, Chinese local histories inform us that there was situated near the mouth of the Changchow River, about twenty miles from the present treaty port of Amoy, a large commercial emporium trading with foreign countries, called Yuch-kiang, and in the dialect of the place Geh-kong. In this Geh-kong I recognise Marco Polo's Caykong, the Arab Scherkham, and Friar Oderic's Carchan.

I am unable to give any satisfactory solution as to the derivation of the name Zayton, which appears to have been the name by which Geh-king was so well known among traders and travellers in the Middle Ages.

D'Herbelot also states that the Chinese called it Schengin, which is really no other than the city of Changchow, situated about fifteen miles further up the river, of which Geh-king, at its mouth, was the port.

Edrisi, in his 'Geography,' makes mention of Changchow under the name of Djankou, and speaks of it as a town remarkable for the beauty of its buildings and its fine markets, and of the fruitfulness of its gardens and its orchards. Mention is also made of its great silk manufactures, and that everything is as readily procured there as at Kanfu (Canton).

This account of Changchow given us by Edrisi dates back as far as the middle of the twelfth century; and, as early as the end of the ninth century, Chinese records inform us that foreign ships resorted to this neighbourhood.

It was about 1086 that the marshes in the neighbourhood of Geh-kong were first drained, and a commercial city founded there.

After the middle of the sixteenth century no mention whatever is made of Geh-kong, for at the time above named the city of Hai-téng was built upon its site, and the whole district was from that date known as Hai-téng, which name its bears to this day.

The great manufacture of this district in Marco Polo's time was silk, and Ibn Batuta is very truthful when he says, "in it they make the best flowered and coloured silks, as well as satins, which are therefore preferred to those made in other places." Local histories inform us that Changchow did for a long time excel the cities of Hangchow and Soochow in its silk manufactures, but its great speciality was a kind of embroidered velvet, and this, no doubt, is what our traveller alluded to when, speaking of Zaitun, he said, "in it are many artificers in embroidered and arras work."

Silk manufactories still exist in the city of Changchow, but, owing to the devastations committed by the Taiping rebels there in 1864, this branch of industry is nearly stamped out. I saw, whilst visiting the city last year, a few looms still working, but I question very much whether this manufacture will ever again flourish there.

Tingin, a place mentioned in the neighbourhood of Zayton as famous for its porcelain manufacture, next demands our attention.

This Tingin is, I consider, the city of Tung-gan, locally called Tengwa, which is situated on another river to the northward of Amoy, and lies on the high-road between Choan-chin and Changchow, and must have been passed through by Marco Polo on his way from Kangin to Zayton. Much coarse porcelain (especially bowls) is made there, which finds its way to Singapore, Java, and other places in the Eastern Archipelago.

I will, in conclusion, make a few short remarks concerning Chincheo, which Colonel Yule identifies with the "old Zayton."

The learned commentator of Marco Polo is quite right in this

assertion, but Chincheo represents the city of Chang-chow-foo, and not Chaun-chow-foo.

The derivation of the name Chincheo is thus given by Navarette, in his description of Chang-chow-foo : " This city," says he, " is very famous in China. All the Chinese who trade with Manilla come from this district. On this account they are called Chin-cheos (and the town Chincheo and Chinchew) by the Spaniards."

Portuguese and Spaniards with whom I have conversed at Amoy, when speaking of Changchow, always called it Chincheo. In 'Kerr's Travels,' vol. vi. p. 382, we are informed—" That the Portuguese, on being driven from Liampo (Ningpo), obtained leave in 1547, by great presents, to settle in the province of Chincheo, in a village which began to flourish in consequence of a rich trade."

In the history of Changchow there are to be found scattered notices of the Portuguese resorting to this neighbourhood. Among other matters we find that, on being driven away from the Canton waters, they tried to carry on a trade in the Chang-chow prefecture, which they succeeded in doing by bribing the authorities.

The rendezvous of this trade was on the island of Wuseu, one of the six islands at the entrance of the harbour of Amoy.

In 1548, the existence of this trade coming to the ears of the viceroy of the province, orders were given to attack and drive away the Portuguese vessels anchored at Wuseu, and Chinese merchants and others who had dared to trade with them were, to the number of ninety, cruelly put to death.

It does not come within the province of this paper to accompany Marco Polo further than his port of embarkation, Zayton, but one could easily do so, and find many new and interesting coincidences in the works of mediæval Chinese navigators, wherein are described every country mentioned by Marco Polo, from Zayton to Ormus, in the Persian Gulf, in the same order, and in almost our traveller's own words.

From this fact I am inclined to consider that Marco Polo, when dictating his book, did, in the description of these particular places in question, now and again refresh his memory from some Chinese geographical treatise ; and, if such were the case, Chinese will have to be numbered among his linguistic acquirements. I would, in conclusion, be allowed to state that I consider that a careful study of the works of Chinese geographers will throw great light upon many curious passages met with in the works of mediæval travellers : one example alone will be sufficient for our purpose.

It will be remembered by those acquainted with the works of travellers to the East in the Middle Ages, that the Pole-star is spoken of as being so many cubits, and, by Friar Jordanus, as so many digits high. Now, this expression is purely a Chinese one, and I have in my possession a set of Chinese maps, published, I believe, in the tenth century, in which the latitude of places in India indicated thereon is shown by the number of digits that the Pole-star appears to be above the horizon.

The foregoing paper will be printed entire, with a Map, in the 'Journal.'

Sir RUTHERFORD ALCOCK said, in connection with these papers, that he thought it might interest those present to see a specimen of Brick-tea, a painting, made on the spot, of the Great Wall of China, and also a brick from the wall itself. The currency in Mongolia consisted chiefly of bricks of tea, two or three specimens of which he exhibited to the meeting. These bricks were made up chiefly of the coarser leaves and twigs of tea-trees, moulded together with some glutinous matter, commonly supposed to be bullock's blood. The Abbé Huc gave an amusing account of the way in which he saw this brick-tea used by the Mongols. They first collected the droppings of the sheep, the only fuel in those arid regions, to make a fire. They then broke off some of the tea, which they pounded and put into brackish water, and made it boil. With this they mixed some salt, and then thickened it with flour and a little mutton fat. This was the food the Mongols had to depend upon when travelling over the steppes. Sometimes, if they could get it, they threw a cup of milk into the soup. An enormous trade was carried on in this brick-tea through Mongolia and Tartary. It was very portable, did not easily spoil, and had no particular delicacy of flavour to deteriorate, so that it was most useful both as a currency and an article of food. Sir Rutherford also exhibited a painting of the Great Wall of China, and also two bricks which he had brought from there, observing that what a thousand years had not done in Mongolia a single year had done in London; for the bricks, which were quite sound when he first took them, had split up since they had been exposed to the atmosphere of London. They were unbaked bricks, and seemed as hard as stone, and probably would have endured for thousands of years longer had they not been removed. The Great Wall, built 250 years before the Christian era, was wonderful evidence of national unity, power, and industry. It extended some 1500 miles, over the tops of the highest mountains, in the most inaccessible places. No Mongolian or Chinese despot could have carried out such a work, if it had not been the feeling of the whole nation that it was necessary for their safety. The Great Wall and the Great Canal were works compared with which the Suez Canal was a mere bagatelle; yet they were carried out at a time when Europe was in a state of utter barbarism. Formerly the nomads made continual incursions into the rich plains of China, as they also did into all the southern parts of Asia, but now the civilised people were pressing the nomads back again. Abbé Huc related how a Chinese debt-collector claimed brotherhood with him on the ground that both the Chinese and the Westerns were "eating up" the simple Mongols; and by their civilisation and wiles the Chinese were now driving the Mongols into the most inhospitable part of their country. The work done by Mr. Phillips and Dr. Bushell was, of course, very fragmentary. But such contributions were the small rivulets that in time by combining made the great stream of knowledge. As Sir Samuel Baker had said, it was only by tracing

the connection between the river-courses and the great lakes of Africa that first civilisation, then commerce, then Christianity, could ever be introduced into that continent. The great African explorers were doing this great work, though they were doing it imperfectly and in fragments. Livingstone was a great and glorious example of one who had devoted his life to the work, and who had died in the prosecution of it, but his life had not been spent in vain. We all, in fact, seek to do some complete work, but never succeed. Link after link will be added to the chain of knowledge, though Livingstone is dead and gone.

Mr. BABER said he had heard that the Mongols in the district through which Dr. Bushell had travelled made a species of wine from mutton. But he expected it was a kind of beer flavoured with mutton. He himself had eaten the pancakes formed on the top of boiled milk, and he quite enjoyed them. He had lately been travelling in Formosa. The western portion of that island was inhabited by Chinese; the eastern portion by the aborigines, who belonged to the Malay race. One curious fact connected with these aborigines was that they possessed but one musical instrument—the Jews'-harp—formed out of a piece of bamboo, split down the middle, and a brass tongue inserted. It was played between the lips, just as an ordinary Jews'-harp, and a piece of string at the end was twanged. The sound was identical with that of the common iron Jews'-harp.

Dr. LOCKHART said that the whole country, from Central China right through into Mongolia, and far back to the western provinces, was one immense coalfield, producing coal as good as that of Newcastle and South Wales, with a good deal of anthracite, and still more of a common though very useful kind. The Chinese brought down large quantities from the hills to the west of Peking, on the backs of camels. At present the Chinese merely scratched the surface, for they had no machinery with which to reach the deeper coal, and the means of transit to the capital were very imperfect; but he believed that when steam machinery was introduced the coal measures of China would do commercially for that country as much as the coal of England had done for this country.

The Rev. JOSEPH EDKINS said that, from a geographical and ethnological point of view, Peking was a very good place to live in, because there several races met, several languages were spoken, and various geological formations were brought into conjunction with one another. The Great Wall was the boundary of the great plain on which Peking was situated, and which was watered by rivers flowing down from the plateau of Central Asia. When travelling through California and up the Sierra Nevada, he had been struck by the resemblance between the physical geography of the neighbourhood of Peking and that of the North American continent. In both cases the traveller ascended from a vast plain through a broad band of high mountains to a plateau beyond. These mountains in the Peking region, though they had not a Yosemite, were interspersed with beautiful valleys and pretty brooks, and here and there an overshot mill used for grinding corn or incense. Higher still he came to a great grassy plain, and farther on the desert was reached. The Russians were the most distinguished authorities upon Mongolia and Siberia, and they, not an Englishman, ought to have discovered the ancient residence of the Mongol emperors, Shangtu. In a short time the Archimandrite Palladius would make a journey to those districts, and, as he was a man of profound knowledge and scholarly instincts, it was to be hoped that his investigations, combined with those of Dr. Bushell and other explorers, would afford some distinct knowledge of the topography, geography, and archaeology of that part of the world.

*Seventh Meeting, 23rd February, 1874.*

THE RIGHT HON. SIR BARTLE E. FRERE, K.C.B., K.C.S.I., ETC.,  
PRESIDENT, in the Chair.

ELECTIONS.—*Alexander Dunlop Anderson, Esq.; John Hugh Bainbridge, Esq.; Francis Crowe, LL.D.; Frederick Fawcett, M.D.; James Grant Fraser, C.E.; Reginald Hankey, Esq.; Percy Hope, Esq.; Capt. J. Edward Hunter, R.N.; Capt. David Miller, R.N.; William Packe, Esq.; Hon. Walter Courtenay Pepys; Theodore Porges, Esq.; Capt. Ebenezer Rogers; Major-General H. S. Rowan, C.B.; George Richard Stevens, Esq.; H. G. Turner, Esq.; Rev. Arthur N. West.*

PRESENTATIONS.—*T. R. Buchanan, Esq.; M. W. Richards, Esq.; Rupert Smith, Esq.; William Augustus Older, Esq.; Captain T. C. Clarke, R.A.; Lieutenant W. T. Gill, R.E.; Dr. Francis Crowe.*

ACCESSIONS TO THE LIBRARY FROM FEBRUARY 9TH TO FEBRUARY 23RD, 1874.—‘Contributions to Extinct Fauna of the Western Territories.’ By J. Leidy. Washington, 1873. Donor F. V. Hayden. ‘The Adirondack Wilderness of New York.’ By V. Colvin. Albany, 1873. Donor the author. ‘Two Years in Peru.’ By T. J. Hutchinson. 2 vols. 1873. Donor the author. ‘Soundings taken by H.M.S. *Challenger* in the North and South Atlantic Oceans.’ By Captain G. S. Nares, R.N. Donors the Admiralty. ‘Revista de Antropologia.’ Madrid, 1874. Donor the editor. ‘The Province of Hunan.’ By Baron Richthoven. 1870. Donor J. Anderson, Esq.

ACCESSIONS TO MAP-ROOM SINCE THE LAST MEETING OF FEBRUARY 9TH, 1874.—5 Maps from the ‘Mittheilungen,’ by Dr. Petermann, viz.: 1. Map of the World, Two Hemispheres, showing the Density of Population; 2. Map of Europe, showing the Density of Population; 3. Asiatic Russia, showing the Route of Graf Hans Wiltschek; 4. North-east part of Persia, showing the Route of Lovett, Goldsmid, and St. John; 5. Map of the Eastern Extreme of New Guinea. By Captain Moresby. Presented by Dr. Petermann. Map of the World, on Mercator’s Projection, showing the principal Caravan and other Routes of Eastern Commerce, Ancient and Modern. Presented by Dr. J. Yeats, LL.D. 2 Maps of China, in native characters. Presented by J. Anderson, Esq., F.R.G.S. 56 Sheets of the French Charts. Presented by the Dépôt de la Marine.

The PRESIDENT announced that he had received a note from Mr. Gladstone’s private secretary, stating that Mr. Gladstone proposed, as his last official

act, to recommend to the Queen that the children of Dr. Livingstone should receive a pension of 200*l.* per annum. Among the Fellows of the Society there would be but one feeling with regard to the suitability of this mark of Her Majesty's favour towards the great traveller.

Since the last meeting of the Society a great number of letters had been received from the members of the Relief Expedition, and as each letter came in it caused a fluctuation in the feelings of those who received it, as to whether it added to the evidence that Livingstone was no more, or gave some encouragement to the hope that he might be still alive. On the one hand there was a general likeness in all the statements that were received, though they came from three writers who might be expected to give different accounts of what they had heard and seen of the messenger upon whose information their belief in Dr. Livingstone's death was founded. It was, however, very singular that they all seemed to refer to but one set of facts, such as might have been brought in by one messenger from a distance, and none of them gave those variations which might have been expected in the accounts of people who had had the power of cross-examining the witness upon whose testimony they relied. It was still more extraordinary that none of them seemed to speak of that witness as if they had seen and heard him. It was quite possible that all the letters yet received might have been written from the information given by a messenger who had merely brought in a message from somebody who was still at some distance. This was the sole ground for hope. On the other hand there were a great many circumstances which looked as if it were impossible that the story of Livingstone's death could have been invented. From the Nassick youths, who were sent by the Church Missionary Society to accompany Livingstone, and from his faithful servant Chumah, who had been with him through all his later wanderings, no doubt authentic accounts of his fate would be eventually obtained. From what he had said it would be seen that there was still room for a very painful doubt as to the truth of the information received.

#### THE LIVINGSTONE EAST COAST AID EXPEDITION.

##### NEWS OF THE DEATH OF DR. LIVINGSTONE.

The following letters and extracts of letters from Lieutenants Cameron and Murphy were then read by the Secretary, Mr. C. R. Markham, C.B., F.R.S.

##### 1.—*Lieutenant CAMERON to Sir BARTLE FRERE.*

“ MY DEAR SIR BARTLE,

“ Unyanyembe, October 20th, 1873.

“ I must write to you to tell you of the sad news of Dr. Livingstone's death.

“ We heard of it two or three days ago from Chumoi [Chumah], his servant, who had come in advance to obtain stores, as the caravan (which is bringing the body) is utterly destitute. He died about four or five months ago, whilst looking for the Fountains of Herodotus, after having been round Lake Bemba, of dysentery, after a fortnight's sickness.

“ I have (as well as both the others) been greatly knocked about by sickness here; I have had eight good goes of fever, besides an attack of ophthalmia, which renders my seeing a matter of some difficulty still.

“ Mr. Markham will be able to tell you all about us.

“ I have been obliged to draw to buy stores, but it was absolutely necessary.

" We had only thirteen bales when our pagazi [porters] engaged to here were paid off.

" Please remember me kindly to Lady Frere and your family, and also to the members of your staff when you meet them.

" Please excuse this short note, as my eyes are tired out.

" Dillon and Murphy both desire to be remembered to you.

" V. LOVETT CAMERON, R.N."

2.—*Lieutenant CAMERON to the Secretary of the Royal Geographical Society.*

" DEAR SIR,

" Unyanyembe, October 16th, 1873.

" It is with extreme regret I write to announce to you the melancholy news of the death of Dr. Livingstone, of which we received news from Chumoi, his servant, who came in in advance of his caravan, in order to get some stores, as he says they are utterly destitute.

" From his report (Chumoi's), they passed the northern shores of Lake Bemba, and arrived at about 10° s. lat. on the Luapula, when the Doctor was attacked with dysentery, which carried him off in about ten days or a fortnight. His servants have disembowelled the corpse and filled it with salt, and put brandy into the mouth, &c., so as to preserve it, and are bringing it along with them. They have also two boxes of books with them, and say there is another at Ujiji, which the Doctor told them to fetch and take down to the coast with them; so I intend, as the caravan consists of seventy or eighty men, to send part down to the coast at once with the body, and take part to Ujiji, to bring back the said box.

" I intend now to strike, as soon as possible, for the furthest point reached by the Doctor in 1871, and endeavour to trace the river Lualaba to its outlet; for this I have sufficient stores, but I have been obliged to purchase largely here, at very high prices, the Arabs charging 15 dollars for a piece of satine (very inferior sheeting) which might cost 3 dollars at Zanzibar; certainly they are almost out of stores themselves.

" It is very difficult to get pagazi, as Mirambo's men are all over the country, and infest every road in the country, and they are all afraid to go. However, I am in hopes of getting off now, as soon as I have seen the Doctor's body started for the coast.

" The reason of our long stay is the amount of illness. I have had eight fevers and a bad attack of inflammation of the eyes, which for some time rendered me quite blind; and even now I am unable to use them for long, and my sight is hazy and indistinct.

" On our arrival here, after paying off pagazi, we only had thirteen bales of cloth left, so that I was obliged to purchase largely, especially as I thought Dr. Livingstone would stand in need of supplies; and as it turns out, he was nearly destitute at the time of his death.

" Mr. Markham will be able to give you more details from a letter to him, but I cannot now write more on account of my eyes.

" V. LOVETT CAMERON,

" Lieutenant R.N.

" P.S.—Send no supplies until further news from us.

" To the Secretary of the  
" Royal Geographical Society, London."

3.—*Extracts from Lieutenant CAMERON's Private Letters.*

" Unyanyembe, August 22nd, 1873.

" We have all been down with fever since we have been here,\* but are now pulling round again. It is a great nuisance, as the fever made me lose my lunars. I tried, directly I was able to think, to get some, but was so shaky and dazed it was utterly impossible. I am afraid Dillon must go back, as he is getting quite blind ; in fact, the last day or two he has been unable to read or write. One eye was affected first, and now the other is going. He ought decidedly, in my opinion, to go back, and I have strongly advised him to do so. Murphy seems to be better than I have seen him since he joined us at Rehenneko, although he has had his share of fever since we arrived here. The Arabs here are as civil and kind as possible, and seem inclined to help us all they can.†

" Our road up from Mdabwu was void of interest, except that we had some arrows fired into our camp by Ruba Ruba, just before we got into Unyanyembe. By the way, Kazeh and Taborah turn out to be one and the same place, and the name Kazeh is well known to all the Arabs here. They laugh at Stanley's idea of Kazeh meaning a kingdom."

" September 10th, 1873.

" Since I wrote the foregoing I have been down twice more with fever, but I am now, thank God, clear of it. We are now waiting for pagazi, and putting our donkey saddle-bags to rights, prior to starting for Ujiji, which I find can be reached in twenty-two marches, or about thirty days. I have been obliged to buy cloth here at exorbitant rates ; which would have been avoided if I had been in a position to hire pagazi to bring on what I had bought at Zanzibar, instead of having to sell it at a loss to pay men.‡ However, now I think we are right to go, by Ujiji, to join Livingstone. In the mean time I am sending my head man Issa to Zanzibar to get what stores he can,§ and come back and meet us at Uganda, when we might either go right round the Victoria N'yanza, and home by the Asua branch of the Nile, or round the south side, and back by Kenia and Kilimanjaro. I should like an answer on this point to meet me at M'tesa's. The Victoria N'yanza ought decidedly to be kept intact on the maps until it has been properly explored ; for I have taken great trouble to find out about it, and one Arab named Sangoro, who has a tembe at Ukerewe, says he has travelled up the eastern side to the Bahari Ngo, and that Speke's map is right, and laughs at the other. I find nothing is known of part of our route, namely, that near the Balegga Mountains, but I do not anticipate any difficulty. Some of the surplus water of the Tanganyika is reported to drain off, in the rainy season, by way of the Rukwa lagoon or swamp, during which time the Rukwa is impassable. I suppose Livingstone will have found out all about this in his present journey.

" I have made out our maps as far as this place, which agrees with Speke's observations, and my dead reckoning makes my previous sights agree.|| All

\* Cameron was attacked with a low bilious fever on August 10th.

† Dr. Dillon says : "The Arabs called every day, bringing sweet limes, pomegranates, or custard-apples."

‡ "Lieutenant Murphy being left to bring on the stores which Cameron counted on, sold some at an immense loss to hire pagazis to bring up what remained."—MRS. CAMERON.

§ Some of Lieutenant Cameron's stores were left at Zanzibar in charge of Dr. Kirk.

|| Lieutenant Cameron had taken 19 observations for latitude, and 4 for longitude. The sketch maps of the route have arrived, and are in the hands of Captain George, Curator of the Map Department, R.G.S.

notes on the geology and natural history of the region we passed through will be found in my journal. I am happy to say I have arranged already about the canoes for crossing the Tanganyika at Ujiji, having secured two which will take from three to four donkeys each, besides men and loads; so I hope not to be delayed there for any time. I think the correct place to steer for will be the underground dwellings, and there we shall, I hope, either find the Doctor or hear of his whereabouts. The Arabs here are going to give us an escort past Mirambo's country. Our askari are such fearful cowards that one cannot trust them. I believe Bambay, and about four others, are all that would stand by us in case of a row, unless we were encamped with a strong boma round us to prevent their bolting."

" September 20th, 1873.

" It is dreadful, this waiting here for lack of pagazi. If I had been well, we should have been away weeks ago, but out of forty-five days\* I have had one fever of eight days,† one of seven, one of five,‡ one of four,§ and now am just getting well of a violent attack of headache, which lasted for five days; so I have only had sixteen days well. Dillon is much better, and has decided to go on."

" September 27th, 1873.

" Still detained by lack of pagazi, but I hope to be off in about two days or so. I have just had another attack of fever,|| and this is the first day I have been able to do anything. Dillon has fever every other day, but not very violently. I am most afraid of his sight. He has quite lost the use of his left eye, and has occasional symptoms in his right. It is atony of the optic nerve. He himself says that getting back to a temperate climate is the only thing to do him good. I also, unfortunately, have a slight touch of ophthalmia in my right eye, which prevents my taking sights. I am trying the left eye, but it does not work well. To-day I am expecting a visit from an Arab who has just come from Katanga, and from whom I hope to have some news of the Doctor. To-morrow, thank goodness, I intend to make a start."

" September 29th, 1873.

" Yesterday, by dint of great labour, I got 16 pagazi together at about 2 P.M.; but to-day they are all collected at Taborah, and afraid to go on, and I am here with my tent cleared out, and not a soul to move a thing. I am thinking of going on by myself as light as I can, if I can get enough of the pagazi I have already engaged. I know I could cut adrift a lot of gear, which, if the other two come, must come also, and, if to-morrow is not more satisfactory, I shall set about it at once. I have been over to Taborah to try and get the pagazi to come, but it is dreadful. Oh! for a chance to get out of this fever-stricken spot and to feel one is doing something. I would go on even if I had to walk barefoot all the way. If I went on by myself I would take 9 askari, and arm 6 of the best pagazi with spare rifles, which, with my servant, would give me 16 well armed men besides myself. If I could only get them to stick together I should be perfectly confident about it. *Couïte que couïte* I must go on somehow or another, as I do not feel justified in stopping here any longer."

\* August 6th to September 20th.

† August 10th to 18th.

‡ These two attacks were between August 22nd and September 10th.

§ Between September 10th and 20th.

|| His fifth fever since arriving at Unyanyembe.

"October 16th, 1873.

" Since I wrote last \* I have been quite blind of both eyes, and very bad indeed with fever. So I have been helpless. We have just received news † of Dr. Livingstone's death; and all his people, with his body, will be here in a few days. Livingstone first reached the middle of the north shore of Lake Bemba; ‡ being unable to cross, he doubled back and rounded it, crossing, besides the Chambesi, three other rivers flowing into the lake. He then went (as far as I can make out) looking for the Fountains of Herodotus, and, I think, crossed the Luapula, marching in a dreadful marshy country, with the water, for three hours at a time, above their waists. Ten of the men died, and several ran. His caravan now consists of 79 men. No doubt I shall learn more when it arrives. Livingstone died of dysentery soon after crossing the Luapula, § about four or five months ago. So the Arab, who said he saw him well at Katanga about two months or so ago, must have been mistaken.

" These horrible fevers, and my blindness, have quite prevented my doing anything since I last wrote, and my eyes now are far from perfect. However, they are getting better rapidly."

#### 4.—*Extract from a Letter of Lieut. MURPHY, R.A.*

"Unyanyembe, October 18th, 1873.

" We have been expecting for several weeks to have an opportunity of sending letters down from here to the coast by a responsible hand, but the departure of our own man has been continually put off, and in the present disturbed state of the country, with the Arabs hostile to us, though they conceal it, we did not like sending by any of the Arab caravans. However, a few letters have to be sent down at once now, and we must trust them, for we have received the very important intelligence that Dr. Livingstone is dead. Two days ago one of his chief men (educated under Dr. Wilson at Bombay), having a letter written by another of his followers, also a pupil of Dr. Wilson's, called Jacob Wainwright (a negro in spite of his name), saying that as they had heard that Dr. Livingstone's son was here, they were bringing in his father's body (he having died from illness), which they had pickled after a fashion and carried so far. From the messenger we learned that on leaving this place on parting with Stanley, Dr. Livingstone had gone south of the Lake Tanganyika, and, crossing the Chambesi, had travelled along the south side of the Lake Bemba, || crossing three small rivers, was there taken ill, and had to be carried on a litter, and going on round the lake had died, apparently of dysentery, before reaching the River Luapula. ¶ His followers had then subjected the body to a rough process of preservation, and taking it with them, spite of the greatest opposition on the part of the inhabitants of the country through which they passed, whose superstitious fears were roused, they had brought it thus far to show that their master was really dead, and that they had not deserted him. So poor Dr. Livingstone is gone at last, without being

\* "On September 30th Cameron was struck down with what Dr. Dillon calls a *very severe* attack of fever, and was *quite* blind of both eyes until October 14th, when he was able to see dimly with one."—MRS. CAMERON.

† Brought by Livingstone's servant, named Chumah. Lieutenant Murphy adds that Chumah brought a letter from Jacob Wainwright, one of the Nassick boys who was with Dr. Livingstone.

‡ Or Bangweolo.

§ Lieutenant Murphy says, "before reaching the river Luapula."

|| Or Bangweolo. ¶ Cameron says, "after crossing the Luapula."

allowed to complete the final link in the chain of his discoveries, as he always thought this last journey would enable him to do. It will now be our duty to proceed to the furthest point he reached on his former journey, and take up his exploration from there."

*5.—Despatch from CAPTAIN PRIDEAUX, H.M. Acting Consul-General at Zanzibar, to EARL GRANVILLE.*

" MY LORD,

" Zanzibar, January 12th, 1874.

" I have the honour to acquaint your Lordship that for some weeks past rumours have been prevalent in Zanzibar, to the effect that Dr. Livingstone had died near Ujiji, and that his body had been preserved and enclosed in a box for transportation to the coast.

" 2. On the 3rd January these rumours were confirmed by letters received from Lieutenant V. L. Cameron, R.N., commanding the Livingstone East Coast Expedition, the latest of which was dated Unyanyembe, October 22, 1873. As these letters were forwarded under flying seal for the information of the Political Agent, I have been able to glean from them the following particulars regarding the latest movements of Dr. Livingstone, and the circumstances attending his death.

" 3. It appears from the information given to Lieutenant Cameron by the Doctor's servant, Chumah, that Livingstone proceeded from Ujiji to the middle of the northern shore of Lake Bemba (Bangweolo), and that, being unable to cross it, he retraced his steps and rounded it to the southward, crossing besides the Chambeze three other rivers which flowed into the lake. He then went (so far as Lieutenant Cameron is able to make out) in search of the ancient Fountains of Herodotus, and eventually turned to the eastward and crossed the Luapula. After marching for some days through an extremely marshy country, in which, sometimes for three hours at a time, the water stood above the waists of the travellers, the Doctor succumbed to an attack of dysentery, which carried him off after an illness of ten or fifteen days. During this trying journey two of his men died, and several deserted. The remainder, seventy-nine in number, disembowelled the corpse, and embalmed it as well as they were able with salt and brandy. On nearing Unyanyembe, Chumah, with a few others, started ahead in order to procure supplies, as the party was nearly starving; and the remainder, with the body, were reported to be distant from ten to twenty days' march from Unyanyembe at the date of Lieutenant Cameron's letter.

" 4. It will be seen, on reference to Dr. Livingstone's last communication to your Lordship's address (dated 1st July, 1872), that the account given by the Doctor's servants of his latest movements agrees in the main with the route sketched out by the traveller himself before leaving Unyanyembe. His intention was to go southwards to Ufipa, then round the south end of Tanganyika, and, crossing the Chambeze, to proceed west along the shore of Lake Bangweolo. Being then in lat. 12° S., his wish was to go straight west to the ancient fountains reported at that end of the watershed, then to turn north to the copper-mines of Katanga, and, after visiting the underground excavations, to proceed to the head of Lake Lincoln, whence he would retire along Lake Kamolindo towards Ujiji and home. He distinctly stated that it was not his intention to return northward through the Manyuema country; and, as he estimated the duration of his journey from Ujiji and back again at eight months, it is not unreasonable to infer that the design had been completely carried out, and that Livingstone was on his homeward journey when attacked by the disease to which he fell a victim. This supposition is rendered more

probable by the fact that when the Doctor left Unyanyembe he was well supplied with stores and provisions, and that he is reported by his servants to have been nearly destitute at the time of his death.

" 5. A letter, which I received the same day (January 3) from Sa'id bin Salim, the Arab Governor of Unyanyembe, further informed me that the death occurred at Lobisa. If this is correct, and if that district is accurately laid down upon the maps, Dr. Livingstone must have proceeded further to the eastward than was supposed by Lieutenant Cameron, who fixes the spot when he died approximately at  $10^{\circ}$  s. lat. and  $28^{\circ}$  e. long.

" 6. The messenger, who brought Lieutenant Cameron's letters, reports that the road from Ujiji to the coast is now perfectly clear; and that, as Mirambo is entirely destitute of ammunition, nothing is to be feared from him or his adherents. In fact, he asserts that there is not a charge of powder in the whole country.

" 7. As a mark of respect to the memory of Dr. Livingstone, the flagstaff of this Agency was kept at half-mast from sunrise to sunset on the 5th of January. This example was followed by His Highness the Sultan, by Her Majesty's ships-of-war then in harbour, the *Briton* and the *Daphne*, and by the Consular representatives of the other foreign Powers at Zanzibar, from all of whom I received letters of condolence on the death of this eminent explorer and distinguished servant of the Queen.

" I have, &c.,

(Signed) " W. F. PRIDEAUX."

Mr. E. HUTCHINSON (Secretary to the Church Missionary Society) had at first entertained some doubts of the credibility of the statements with regard to Livingstone's death, resting, as they appeared to, on mere native evidence, until he saw the name of Jacob Wainwright mentioned in the papers, but then he feared the worst. In the early part of 1872 the Church Missionary Society, feeling a deep interest in Dr. Livingstone, and knowing that it had at the Nassick Asylum material available for his purposes, suggested that some of the Nassick boys should be sent to him. They telegraphed to Mr. Price, who had charge of the asylum, to ask for volunteers to go with Livingstone. The offers were so numerous that it was a difficult matter to make a selection, but six were finally chosen, their leader being Jacob Wainwright, whom Mr. Price described as a well-educated, thoroughly reliable, earnest, good young man. The party started early in 1872, arrived at Zanzibar just after the Dawson Expedition had been arranged, and reached Livingstone in August, 1872. If the news were true that Chumah, bearing a letter from Jacob Wainwright, had arrived at the place from which Lieut. Murphy had written, there could be very little doubt that what Jacob Wainwright had written was true, and that Dr. Livingstone was no more. If the circumstances justified it, the Church Missionary Society would probably bring Wainwright home to England, before he was finally sent to Mombas to assist in the suppression of the East African slave-trade.

The PRESIDENT explained that the Nassick lads referred to by Mr. Hutchinson were liberated slaves, who had been educated as Christians at the Nassick Asylum of the Church Missionary Society, a short distance from Bombay. When he visited India Dr. Livingstone spent a couple of days at Nassick, and took some of the young men away with him. He was extremely pleased with all that he saw at the asylum, and he relied upon the boys as likely to be most useful assistants to him in his travels. As far as was known, none of those boys had failed him. As soon as it was determined to send out the expedition which preceded that of Lieutenant Cameron, the Church Missionary Society sent six more to join their companions. The Society would be glad to hear that as soon as Dean Stanley, at St. Petersburg, heard of the reported

death of Dr. Livingstone, he wrote to Sir Henry Rawlinson and told him that, though it was very unusual for the authorities at Westminster Abbey to take any steps in anticipation of an application to them from the friends of any great man who might be deceased, yet that he felt this was such a special occasion that he begged Sir Henry to remember that in the event of Dr. Livingstone's body being brought to England, he would be glad to give him a resting-place in the great Abbey.

#### AUSTRALIAN EXPLORATION.

Referring then to the recent successful expeditions across the interior of Western Australia, the PRESIDENT said :—Members of the Society will have learnt from the papers the news of the success of one of the expeditions which had started from the Telegraph line, in the interior of Australia, in the endeavour to penetrate to the West Coast at Swan River. The successful expedition is that of Colonel Egerton Warburton, who started with camels, instead of horses, as his pack-animals; and, taking a more northerly route than was attempted by others, has reached the Swan River Settlement. The journey, in point of distance travelled and the difficulties of the country, is scarcely inferior to the famous strides across the continent performed by Burke and Wills, and by Macdouall Stuart. In short, it is one of the great geographical exploits of the day ; and great honour is due, not only to the able leader, but to the two private gentlemen of South Australia, the Hon. Thomas Elder and Mr. W. W. Hughes, by whose munificence the expedition was equipped. I will only add that, when a report on the journey reaches the Council, no time will be lost in giving an evening to the subject of this great Australian feat in exploration.

The following papers were then read :—

1. *Exploration of the River Volta, West Africa.* By Captain JAMES A. CROFT.

FOR many years I had been anxious to explore the Volta, so in the early part of 1872 I made an application to the Administrator of the settlement of the Gold Coast, H. T. Ussher, Esq., for a grant of land on the banks of that river, with a view to opening up a commercial intercourse with the Addah people, and from thence with the interior, but first of all establishing a dépôt near the mouth, having at my command a steamer of very shallow draught, which my friend, Messrs. Millers of Glasgow, had built expressly for the Niger and Volta.

Mr. Ussher very kindly granted my request, knowing how very important a step of the kind would be if friendly intercourse and good feeling could be established with the surrounding and interior tribes ; he also promised me every support, and, in case of need, a few Housas to protect the steamer. Unfortunately my kind friend, Mr. Ussher, after labouring and suffering for a number of years, had to succumb from ill-health and return home much regretted ; after

some time Colonel Harley, c.b., was selected, and arrived at Cape Coast to administer the Government.

Having made all arrangements, early in December, 1872, I proceeded to the Volta. Crossing the bar, steaming full speed, about half ebb, and having steam-launch ahead, I followed Captain Glover's directions, which I proved at that time to be quite correct. Upon entering the river fairly, I found that the sea had made a clean breach through the narrow neck of land which formed the west point and acted as well as any breakwater; not a canoe or native being visible anywhere, I fired one of our 4-pounders to wake them up. Proceeding along the west bank until I came to a shed, which afterwards turned out to be Government property, built to store coals, I thought it prudent to anchor, and made fast to the bank *pro tem.* From the description, I reckoned that I could not be far from the ground the Colonial Government had granted me, but little expected that the narrow strip of land which the sea had actually wrested away was *it*; however, it was too true! As it never could have been made use of to build upon, I did not regret this, and immediately applied to Colonel Harley for a fresh grant, which he politely refused, stating that Her Majesty's Government was not in a position to give any further grants. I found afterwards that Her Majesty's share of the land was a swamp, and was quite agreeable that she should retain it, at the same time feeling I had nothing to expect from Colonel Harley. We had not been fast to the bank very long, and were busy landing our deck cargo, which consisted of coals and shooks (the latter are made into casks to put palm-oil into), when a canoe came in sight, and brought alongside Her Majesty's representative, a Sierra Leone gentleman, sub-collector of customs, who amused me by at once showing his great importance, and demanding if I had a permit to land my cargo on this dreary spot of sand, swamp, and mosquitos, miles away from any human habitation. He showed me, at the same time, a printed tariff of everything liable to duty: this I may say took me quite by surprise, never anticipating that my efforts to open up my objects were to be saddled with these duties, having been led to expect that none would be imposed until commerce was fully developed. Two of the chiefs from Addah Foh came with him to welcome me, offering me every assistance. After a long palaver about the prospects of trade, &c., I asked them to accompany me in the steam-launch, and away we went sounding up the right bank; after some time found a channel deep enough as far as Addah Foh, and, landing

my new-made acquaintances at their own village, I returned to the steamer, remaining in the same place for the night.

Not much rest to be obtained except under a good mosquito-curtain that night; all my Europeans (captain, officers, and engineers) had been walking the deck and trying every conceivable plan to get a little sleep. The following day we bid adieu to this nest of mosquitos and sand-flies, and steamed up to Addah Foh, where we were received by the whole of the population with great rejoicing, chiefs and headmen bringing presents of palm-wine, fowls, turkeys, &c., &c. Nothing could exceed their delight as we lay close alongside the bank; they had free access to the steamer, and came and departed as they felt inclined. A small market was quickly established by the natives, and a roaring trade done in vegetables and eatables, with not only the Kroomen and firemen, but amongst themselves, as they remained until dusk, boiled ground-nuts being one of the staple articles of food, with palm-wine to wash it down. We established at once a most friendly feeling. The principal man, Dubarti, gave me the use of his house to store my goods and make a shop of, and procured labourers to land and carry them up; these I paid at the rate of 9d. a day in cowries, but, like all Africans, they very soon got tired of work, and after a few days I found great difficulty in getting them to come.

Dubarti, with his friends and relatives, gave me a piece of land, a waterside frontage of 200 feet, lying back 370 feet, which they soon cleared at my expense, and entered into a contract to build premises upon it. We were busy each day landing and storing the goods away. I frequently amused myself with my double-barrel in the steam-launch, and sounded all the different channels, in the hope of finding one amongst the group of Grass Islands; but it was not until after spending many days at it that a channel was found, with 5 feet of water at half ebb, across a long shoal of about 1½ mile.

My intercourse with the natives soon led to business, and it was not long before palm-oil and palm-kernels were brought for sale. On one of my sounding excursions I paid a visit to the king of Addah, the principal town; he received me in state, calling all his chiefs around him, and professed himself very pleased at my settling amongst them, promising to protect any property I might land. Went through the ceremony of drinking His Majesty's health in some horrible stuff labelled cognac—more like turpentine than anything else—and wished him good-bye, inviting him to pay the steamer a visit. I sent His Majesty afterwards a present of a case of Geneva and a piece of silk, in exchange for some trifling present received, for which he was very grateful. On Christmas-day I gave

a dinner on board, inviting several of the chiefs of Addah Foh, who behaved very nicely on the occasion, and seemed to enjoy our way of cooking. In all my experience I had never met with a better disposed set of natives and keener traders. Finding the Government insisted upon duties being paid, when they were being evaded by the Quittas and Awoonahs, who were smuggling spirits, without any attempt on the part of our Government to stop it from the left bank of the river, I determined to go up to Cape Coast and see Colonel Harley, and get him, if possible, to put a stop to it. It is needless to say, after spending a week and steaming 240 miles for the purpose, I returned with empty promises; neither could I obtain any information from him as regards where the Protectorate ended. The Americans, who carry on the principal part of the rum trade, had only to go a few miles on the east side of the Volta and land all free, and it was afterwards smuggled up the river.

After many delays, caused by my having to meet the various mail-steamers, it was not until the 8th February, 1873, I made a start up river, wishing our friends adieu, who were not best pleased at the idea of our going up, and declared it was a matter of impossibility. At noon we swung round, and away we steamed, going slow or otherwise, according to soundings. We had previously laid down buoys to steer between where it was shallowest. After crossing the first shoal, had to anchor, and wait for the boat to pick them up. After this found but little difficulty, and anchored at 3 P.M. off the town of Grave, amidst the cheers of the people, who flocked on board, capering and dancing all round the decks. Landed, and paid a visit to the king; went through the usual ordeal, after waiting for some time. I am thankful to say it was palm-wine this time, and not cognac. Took a stroll through the town, which was shaded by some fine trees.

The natives had no oil, nor did they trade in anything but live-stock (for which they carry down and sell to the people of Quitta) and Jellah coffee, for supplying Her Majesty's ships and any other vessels calling. The coffee being remarkably cheap, we did a small cash-trade; but finding it was not worth remaining for, proceeded the following day, at noon, up river, having to anchor and sound repeatedly. The crossings were very narrow and shoal, we therefore had to wait for the flood; after doing so safely, picked up the buoys and proceeded, passing several rocks, some above water; soundings very irregular, the banks of the river just below Homie being all rocky, and the colour of ironstone. Abreast of Homie we shoaled suddenly and took the ground, but by disconnecting and working the steamer's head round, first one paddle and then the other, she gradually slipped

off into deep water, anchoring for the night—mosquitos innumerable. The following day the greater portion was spent in sounding; but after finding, as we thought, a channel, with 5 or 6 feet upon it, proceeded, but in crossing again took the ground, remaining firmly fixed for several hours, having when the tide fell about 2 feet of water from the fore rigging. Got all the shovels together, and set all hands to work digging her out; gradually succeeded, and, with the assistance of the engines, she came off; crossing a little lower down, between two buoys, the natives from Teflee visited us, bringing fresh stock for sale, wanting cash in exchange. Anchored late in the day off a place called Blappa; remaining the whole of the following one, to give the natives a chance of trading, if so disposed. Landed to see the chief and the country: it is said to be the high road to the oil-districts. Saw little oil; but altogether a very wretched place, and must be under water when river rises. Weighed the following day, anchoring, surveying as we went along—most of the channels had to be buoyed-reaching a large town, called Battoh, where we anchored. The banks here are exceedingly steep, and, getting higher, I landed and paid my respects to the King and Chiefs, who appeared to be a sulky dram-drinking set, and opposed to our going up the river. Unfortunately my friend here, a man of the name of Quabino Battoh, a good trader, was away at his farms. Finding no channel for the steamer, after sounding in every direction, and spending several days, I determined to leave her under charge of the captain, and proceed by gig to Amedica, giving him directions to act in a friendly manner and buy any produce they might bring on board. It was now that I required my beautiful steam-launch, which had become a wreck on Christmas-day, through the stupidity of those in charge. There was, however, nothing for it but to take the gig and load the surf-boats with cargo and provisions required. Having started our surf-boat overnight, on the morning of the 14th I followed with my friend, Mr. W. Addoe, a native of Accra, in the gig, sounding all the way. No appearance of hostility on the part of the natives: this I was led to expect might occur, but all seemed friendly. At Vloe came across a number of rocks, some just awash and others well above water—no mention of any in any previous survey—took all the necessary bearings, and marked them down. Finding the Kroobois getting fagged, we brought-to under the shade of a large tree and had breakfast, enjoying it very much. The banks of the river were getting very much higher and well wooded—chiefly cotton-trees. Passed the island of Doffoo; the town was destroyed by Governors Ussher and Glover in the colonial steamer *Eko*, in July, 1869, and great numbers killed for marauding and assisting

the Ashantees. We found they had located on the left bank of the river, and were evidently not quite sure whether we were friendly inclined. Through my friend I was able to tell them that I came for trade, and not war, at which they were apparently pleased; but I also threatened to punish them if they molested my boats passing up and down. After passing numerous small villages, and speaking to all in a friendly way, we at last reached Amedica, landed, and climbed up a steep bank, 40 feet high; country thickly wooded. The surf-boat arrived an hour after us, although it had started the previous day. Here I saw for the first time anything like business going on—canoes arriving and departing with palm-oil for the lower part of the river; no houses, only two miserable huts, one of which we chose to sleep in. The first thing we had to attend to was our commissariat, &c. With the assistance of a few gin-cases we formed table and chairs, got a fire underweigh to boil some water and cook some yam, and we managed to make a good hearty meal off a piece of corn-beef which we had brought with us. When about retiring to rest we found the Driver ants about to take possession of our hut; immediately set to work and laid wood-ashes all round as a barrier, which they will never cross, and slept soundly till daylight. Our followers erected tents with four sticks in the ground and a covering of palm-leaves for a roof. As I had a good mosquito-net, I was not troubled by those gentlemen (the mosquitos). The following morning built a bath-room on the same principle as our followers' tents, and spent the day examining the locality. We had a magnificent view of the rapids, the river being studded with rocks, which were bleached by the sun, and had the appearance of small icebergs floating down. I made up my mind to attempt them either in my gig or canoe; my friend did not quite relish the idea, but would not desert me. The canoe-men persuaded me not to attempt it by gig, so by 11 P.M. the following day, after sending off our carriers with their loads by land, we started in a canoe, about 40 feet long and 18 inches wide—very much the shape of a coffin, sharpened at each end—propelled by five men, sometimes paddling, but principally with long poles, which they fixed in the rocks very cleverly. The rapids were very strong in some places, and at times they were scarcely able to force the canoe ahead, and every moment we ran the risk of a capsiz. Fortunately they carried several spare poles, as they frequently got fixed between the rocks, and could not be drawn out. When about half-way there was every sign of a tornado, which forced us to land at a village until it burst and we thought had passed over. We had not proceeded again on our journey very much farther before it

came down a perfect deluge; but, as the evening was drawing on, there was nothing for it but to proceed, as we had not met with a very friendly reception at the last village. We did not reach Kpong until 6.30 P.M., tired and wet through. Our carriers had arrived, and prepared for our arrival. I was very much pleased with my trip, having accomplished what no European had ever attempted, but should not care to risk it again. The little town was quite newly built. With the assistance of two gun-chests I managed to make up a comfortable bed, and for many days slept without a roof—the walls being formed with sticks and palm-leaves interlaced, in preference to the hovels the natives lived in.

After arranging for trade, the palm-oil soon began to flow in from the surrounding country. My surf-boats I found of great use, bringing cargo up to Amedica, and taking oil on their return trip to the steamer. From Amedica everything had to be transported by means of these small canoes, no assistance being rendered by the canoe-men more than poling them, loading and discharging being done by labourers; and even then the canoes might remain for days loaded before these fellows could be induced to work; making you quite dependent upon them, the Aquamoos being the only men who understood the navigation, and who are said to be friendly to the Ashantees. Leaving a clerk to superintend, I made an excursion into the Crobo country, being carried in a hammock by four men, whom I had brought purposely from Accra. Accompanied by my friend Mr. Addo, we had a most delightful journey a distance of some 20 miles, to Odemassie, passing through groves of palm-trees nearly the whole distance, the trees forming a beautiful shade from the sun. On arriving at Odemassie we were comfortably housed by one of the teachers belonging to the German Mission. We found great difficulty in finding carriers, and it was not until the following day that some of our packages arrived.

The houses here are built very neatly, with substantial mud-walls, and you are not troubled with mosquitos or insects. Nothing could have exceeded the friendly reception we met with from the king and his chiefs, and they were glad to hear that I intended to establish a factory at Amedica, and that they would find a market for their palm-oil. Most of the people were at their farms making oil, which they take great trouble to cultivate, and they grow the most delicious yams I ever tasted. Orange and mango-trees were growing all over the town, and the soil was rich enough to produce anything; it was one of the prettiest towns I had ever visited in Africa. They use but little spirits, and drink their palm-wine, which, when fresh from the tree, is most delicious. We paid a visit to the

German Mission ; they were busy building a beautiful house of mud, using all country wood, which is hard, and is not easily destroyed by the ants. Their difficulty was the want of labour—like all parts of Africa—and which is so disheartening. The carpenters and few mechanics they obtained came from Accra, where they educate them themselves at their different establishments. They had a school, which was well attended by the native children. After spending two days here we proceeded to Sera, West Crobo, and had an interview with His Majesty there, who expressed again and again his pleasure at my coming to see him, and opening trade for his people so close to him. As it happened to be market-day, I expressed a wish to make a visit. After a walk of about a mile we reached the market-place, a large open space covering about an acre of ground. All round were sheds, with every conceivable pattern of printed cottons exhibited, and being bartered away in exchange for cowries. In the centre yams, cocons, ground-nuts, palm-oil, were being disposed of, and finding ready purchasers; altogether it was a very amusing scene. My visit rather interrupted business for a time, the little children screaming, rushing off to their mothers for protection, hiding and peeping from behind. The women dress very neatly, and with good taste as to combination of colours. I spent some considerable time here, until they became quite familiar with my strolling amongst them. I did a good business in yams. We returned the following day to Odemassie. After thanking His Majesty for his kindness, we were carried in hammocks under the shade of palm-trees nearly the whole distance; the trees were growing so thick that they were quite stunted in consequence. Here and there was an opening made by their cutting them down, to extract the palm-wine from them; but they did not appear to gather the fruit, or make oil from them.

After spending a day at Odemassie we returned to Kpong, the people in Crobo promising to bring their oil as they collected it. On arriving we found business pretty brisk, and that things had been going on quietly, the great difficulty being the transport of the oil to Amedica. Before leaving that place, on my way up, I had arranged with the chief of a small village, who laid claim to the land, to clear me a piece of ground and build a house upon it. Hearing from my clerk that he had done little or nothing towards carrying out his promise, I proceeded by land this time, walking when the ground would permit, and at other times being carried as usual in a hammock. On the way I succeeded in shooting a brace of partridges; they were unaccustomed to a double-barrel, and got up so close to me, and so much to my astonishment, that I nearly

forgot to fire. But after this I invariably went out either early in the morning or late in the afternoon, seldom returning without something in my bag for my trouble. Arriving at Amedica, I soon ascertained that the lazy fellow (Chief) wanted an advance before I could get him or his people to commence work. Having given him what I thought sufficient, they made a start, and worked for an hour or two a day; but it was only by my incessantly coming over and watching him that I did ultimately get a piece of ground cleared of trees and scrub, and the ant-hills levelled, being frequently from 10 to 15 feet high. I remained at Kpong for a month, going to and fro most days to Amedica to see my oil shipped and sent down to the steamer. The labour was immense. First it had to be shipped in small casks, holding about 50 gallons each, and brought down over the rapids to Amedica, there landed, and all had to be re-started into big casks, holding 240 gallons each, which were placed in the surf-boat empty and then filled, three in each, the small casks having to be returned to Kpong again—the canoe-men generally having a fight not to carry them back. The position of Kpong is just on the bank of the river, which is more like a trout stream, the trees in some places meeting overhead. The heat at this time of the year was something intense, and most days we were visited by a thunderstorm. For a whole fortnight I remained in the place alone. Every day there were rumours of the Ashantees coming, keeping the people in a constant state of fright. I must say I never felt the least alarmed, and I firmly believe that they would not have molested me. We had an Ashantee constantly staying in our factory at Amedica, who appeared to be a very decent, harmless individual. My clerk had known him some time; he told me they had no quarrel with the white man, but had a hatred of the Fantees, and wanted us to let them meet them and have a fair fight without our interference. Up to this time there was no demand for either guns or powder, of which I had a plentiful supply: this evidently shows that they had a good supply themselves, or could obtain it from some other source. I had a great wish to pay a visit to Aquamoo: the king had sent me repeated messengers asking me to come, but I was persuaded out of it by Mr. Addo, who returned about this time from Accra, where he had been to make a contract to supply the Governor with fresh beef, and give one of his daughters away! He brought back with him the Queen's Proclamation about a marauding party of Ashantees having crossed the Prah, &c., &c., prohibiting the sale of ammunition to the enemy. That the Ashantees had crossed the Prah I knew in January, when at Cape Coast.

Having finished all my arrangements, and partially succeeded in building a house, leaving my clerk everything necessary to carry on trade (oil was beginning to come direct to Amedica, doing away with an immense amount of labour), I was obliged to leave, having to meet the mail steamer at Accra and make preparations for my Niger trip. We got down safely, grounding once for a few hours, after, I may say, a very enjoyable time.

I forgot to mention that on my way down I stopped one night at Doffoo and slept, the king and chiefs receiving me kindly. Before leaving he begged me to make him a present of an umbrella to commemorate my visit, being the first white man that had ever paid him such a compliment. The umbrella was not to have any brass about it (on account of his fetish)—a little coal-tar soon altered the appearance of the brass! After my promising him the umbrella, he wanted a few gallons of rum for his chiefs to drink my health, and a piece of cloth for his wife and children to remember me by. I sent him all the presents, and he returned me his thanks, and I have not had the pleasure of seeing him since.

The country generally is mountainous and exceedingly fertile. At Akrapong the missionaries cultivate coffee. Cotton grows freely on the left bank of the river in the Crepee country; but for some years they have been obliged to live in Crobo to escape from slavery, as the Ashantees laid waste the whole country, and they were too cowardly to make a stand.

The temperature I found to be a mean of about  $87^{\circ}$ , with a diurnal range of  $25^{\circ}$ —from  $75^{\circ}$  at night to  $100^{\circ}$  during two or three hours in the afternoon.

The climate, proved by sad experience to be so fatal to Europeans in the immediate coast, I found to improve from point to point as I ascended the river. The habits of the people were peaceful and industrious. I could see no evidence of their working in metals, probably because they were not able to obtain metals to work in; but their manufactures in cotton cloths were extensive. Their religion was identical with that of the Gold Coast, so far as I could see, viz., Fetish and Demonology.

The governments of the various tribes which came under my observation seemed to be based upon despotism, but carried on with much looseness and want of organisation. Judging from the towns and villages I saw, the country may be considered to be, as known Africa goes, fairly populated.

The River Volta, in my opinion, could be made a highway to a valuable interior; but the first difficulties to be removed are the

frivolous and vexatious ordinances and regulations which the legitimate merchant is called upon to observe, and which any unscrupulous trader can evade with impunity, the line of Protectorate being so ill-defined.

Finally, it is to be hoped that our line of protection may be defined as soon and as absolutely as possible; further, it is most to be desired that the opportunity we now have in the successful operations of that able officer Sir Garnet Wolseley and his devoted handful of blue-jackets, marines, and soldiers, may not be lost; but that the road now made for military operations may, as a stipulation, be kept open, and thus, with intercourse cultivated up the Volta, prove a valuable aid in the interests of practical geographical science, by bringing us into more intimate communication with the interior, and throw open a hitherto almost unknown country, containing, in my opinion, the germs of great results in the future.

The PRESIDENT informed the Meeting that Captain Croft had presented to the Society an admirable detailed chart of the Volta, drawn up from his own survey. It was of such material as that afforded by Captain Croft that Hakluyt, Purchas, and the other early geographers, constructed those narratives which had been the delight of all subsequent ages.

Captain CROFT thanked the Society for the attention with which his paper had been listened to. It was the first he had ever written.

Mr. A. HAMILTON said that the locality of Captain Croft's chief labours was the Niger, in which river he had done good service in opening up trade, but he had employed his last half-year's holiday, during the dry season, when the Niger was not navigable, in making a survey of the Volta. It was most desirable that every effort should be made to penetrate into the interior of Africa, and establish commercial intercourse with the people there. Unfortunately the coasts of Africa were inhabited by races of men very much inferior to the races of the interior. This was particularly the case on the West Coast, for there was not a more degraded and worthless class of beings on the face of the earth than those inhabiting the West Coast of Africa. England would have no cause whatever to regret the Ashantees War financially if it resulted in opening up a practicable trade-route. This penetrating into the interior of Africa, so as to carry on trade with the races of the interior, had a direct bearing upon the existence of the slave-trade. Although the trans-atlantic slave-trade on the West Coast had been suppressed, and that on the East Coast was being put a stop to, there still existed a very large trade in human beings in the interior. Between Lake Chad and the River Niger, in the territories of the Soudan, there was a semi-civilised Mahometan race, which had been hitherto supplied with European goods from the shores of the Mediterranean, principally from Tripoli. The cost of transit was, however, so great—being from 35*l.* to 40*l.* per ton—that it was impossible to make any return for those goods, except in such articles as would bear the cost of transit back across the desert; such as ivory, gold-dust, and principally slaves. If, however, a trade-route could be established between those countries and the Bight of Benin, European goods could be delivered at a much cheaper rate, and necessarily the trade with Tripoli would be annihilated, and, as a consequence, the Mahomedan slave-trade would come to an end; for there would be no necessity, as at present, to make returns in slaves, because various articles of

produce which are extremely valuable in manufactures and commerce, would be brought back in exchange. An idea of the obstructiveness and exactions of the intervening tribes was afforded by the fact that, sixteen years ago, a puncheon of oil at the mouth of the Niger cost 44 tons of salt, while, at the confluence of that river with the Chad, only 270 miles up, salt could be exchanged for oil, weight for weight. Captain Croft had established trading stations as far up the river as Egga, not far from the point where Mungo Park was last heard of. He had heard from a friend that when he was at Bida (or Beda) in 1861, a caravan came in from Tripoli, and among other articles that were unpacked was loaf-sugar from Whitechapel. The course of trade now is to send the sugar to the mouth of the Niger, and thence up the river to Bida, so that the ultimate payment, instead of being in slaves to be sent northward across the Desert, is now made in merchandise, which is sent down the Niger, viz., palm-oil, Shea butter, ivory, native cloths, to which in time will be added indigo and other produce, especially such as can be raised with little skill and labour. The spirited and patriotic efforts of Mr. Macgregor Laird had borne good fruit, for there were now three companies regularly engaged in the trade up the Niger, and Captain Croft had made no less than six ascents during last season.

Mr. E. HUTCHINSON said, that from statements which had appeared in the papers, the public might be led to imagine that the trade on the Gold Coast was the whole, or nearly the whole, of the West African trade, but in reality it was only about one-fifth. From 1853 to the present time, the exports and imports on the West Coast amounted to about 30,000,000*l.*, and of that, Ashantee took only about 5,000,000*l.* The survey of the Volta was very interesting from a geographical point of view, but that river never could develop a large trade. The fact was, that the Niger tapped all the trade that could possibly go through the Ashantee country. It would be of great public advantage if more attention were directed to the capabilities of the Niger. It was navigable as far as Boussa, and six or seven steamers every year now carry on the trade from Liverpool. English principles of commercial honesty were beginning to prevail among the natives, and there could be very little doubt that a fair attention to the wants of trade, and the exercise of British influence and moral power, would succeed in opening up an extremely profitable commerce with the districts lying to the north of the Niger and eastward to Lake Chad.

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2. *Notes of a Journey in Yemen.* By CHARLES MILLINGEN, M.D.  
Edinburgh.

I WILL first describe the route between al-Hudaidah and Sana'a, the immediate object of my tour, and will then dwell at somewhat greater length on the tract of country travelled over on the return journey from Sana'a to al-Hudaidah by way of Kaukabān, Tawilah and the valley of the River Sardūd.

Starting from al-Hudaidah, we followed the usual caravan route across the Tihāmah, passing the villages of Marāwah and Kuttāy, and halting at Bājil at the foot of the hills. The Tihāmah, or plain between al-Hudaidah and the hilly country, is about 30 miles in breadth: it is sandy, and slopes gradually toward the sea. The first half adjoining the coast is desert; the well-water is

brackish, and the rainfall is scanty. The other half, however, from its vicinity to the mountains, participates in the frequent showers which fall on them throughout the year, and especially during the heavy summer rains. Hence cotton, *dhurrah*, and millet are extensively cultivated, as well as indigo, *sâlab* (a plant from the fibres of which are made the bags in which coffee is packed), and other useful plants in various parts of this portion of the plain. Date-trees abound in the neighbourhood of Zabid. As a natural consequence, numerous villages are scattered all over the plain, and the markets, which are held on fixed days at the various hamlets, afford every facility for disposing of the produce of the land.

Bâjil, situated as it is at the entrance of the valley which is the highway to Sanaâ, is a village of some importance, and is garrisoned by Turkish soldiers. Leaving Bâjil, one proceeds in an easterly direction to the village of Buháy, in a valley at the foot of Jâbal-Thamûr, and soon after enters the Wâdi Sâham, bounded by Jâbal-Buriâh on one side and by the Harâz Mountains on the other. At Ubbâl the road takes a north-easterly direction, and, leaving Jâbal-Buriâh, skirts the base of the Harâz Mountains, along the right bank of the River Sâham as far as the village and military station of Sanfûr. Crossing the stream at this spot, one leaves it to enter a narrow gorge several miles in length, in which are the caravan stations of Baitu'-sh-Shaikh and Sâham. At length one leaves the gorges of the Jâbal-Harâz and comes to open country at Mifhâk, formerly an Arab shaik's stronghold, but since 1871 a Turkish fortress. The castle is on a basaltic rock, 200 feet in height. Another route, shorter by six hours, is sometimes followed from Bâjil to Mifhâk; it branches off at the village of Buháy, and, after many ascents and descents, leads to the large village and military station of Munâkbah, in the Harâz district—Mifhâk being distant 18 miles from it. The road along the Wâdi-Sâham is preferred by most travellers, as being less mountainous. Camels laden with merchandise invariably take the Wâdi route; on arriving at Sanfûr, the camels of the Tihâmah are exchanged for those of the Jâbal, as the former, from their unwieldy proportions, are very liable to fall and sustain irreparable injury in the hilly country. The mountain camels are very different in appearance, and are light and surefooted. It is the same with the donkeys of the Tihâmah and those of the Jâbal.

From Bâjil to Mifhâk, which must be about 2000 feet above the level of the sea, one rises higher and higher, but almost imperceptibly. At Sâham and Mifhâk the temperature was most agreeable, the nights cool, and the mountain air bracing. The country

is everywhere green, well wooded in some parts, the hill-sides covered with shrubs, and the mountains, even the highest, are clothed with coffee-trees, *Kát*, and cornfields. Acacia-trees of various species, tamarisk, tamarind, and many other trees, new to us, adorn the valleys. There are numerous species of euphorbiaceæ and asclepias. A remarkable tree is the *Oleander obesum*, growing on the rocky hill-sides: its trunk is like a huge pear or turnip, from which issue branches as thick as a finger. The natives call it *Adánn* (which means a dwarfish plant), and ascribe poisonous properties to it. The flowers are smaller than the common oleander, of a rose colour, and possess a fragrant smell. In the Wâdi-Sâham we saw a few screw pines, *Pandanus odoratissimus*. The flowers are much prized by the Arabs, and they are in the habit of wearing them in the folds of their turbans, along with jessamine and other flowers.

A tree called *Thalâj*, a species of *Ficus*, has large leathery leaves, and of all trees affords the most grateful shade. Between Sâham and Mifhâk there is an enormous *Thalâj* tree, many hundred years old. On the road between these two villages there is a small coffee plantation: they are the only coffee-trees that one sees between al-Hudaïdah and Sana'a. Game, such as guinea-hens and red partridges, abound in the wooden ravines; bustard are rare. The red partridge, called *Kaly*, resembles the European red-legged partridge: it is, however, much larger, and the plumage is different. It is widely distributed throughout Yemen and the Hijâs. Gazelles and antelopes are scarce. As regards beasts of prey, such as leopards, hyenas, &c., we fancy that they have long since been exterminated; the country is everywhere cultivated, there are no forests, and man inhabits the most inaccessible mountains. Monkeys, the species of *Pithacus* found throughout Arabia, from al-Medinah to Aden, we saw and heard at times in the Harâz Mountains. Lizards, especially one of a dark-blue colour, often attracted our attention, but we never chanced to see a snake.

Leaving Mifhâk one ascends a steep mountain, well cultivated with cereals, and after passing several villages one reaches the summit of the pass, about 6000 feet above the sea. A northerly wind was blowing, and it was bitterly cold, and we much envied the sheep-skin coats which the peasants, whom we met, were wearing. Descending to Buâ'an we crossed over a bridge, a stream flowing westward—according to Niebuhr, a tributary of the Sâham. We now travelled over level ground, halting at the village of Máthna, and, after a ride of 10 miles, descended about 1000 feet into the plain or valley of Sana'a. The country between

Mifhák and Sana'á affords a contrast quite as striking as the Tihámah to the wooded valleys between Bâjil and Mifhák. One sees nothing but bleak mountains, treeless plains, and black volcanic stones and scoriæ. The air is quite chilly at night, and the sun's heat by day is moderate. Cruttenden estimates the height of this plateau at 5000 feet. The land, however desolate the scenery may be, is well cultivated with wheat, barley, beans, clover, and mustard—the oil expressed from the seeds of the latter being used for lighting purposes. On the sandstone and basaltic hills which border the plain are several villages : the houses, two and three storeys high, in the form of square towers, are built of hewn stone.

Sana'á lies in a valley at the foot of Jábâl-Najúm, and is bounded on the west by a range of sandstone hills, known as the Jumlân and 'Usûr Mountains. The soil consists of sand and pebbles, with volcanic stones containing iron. The plain at Sana'á is about three miles in width, but toward the north it widens, while toward the south it rapidly contracts. A small stream runs northwards, but is entirely used up in watering the various orchards. Sana'á is a walled town, about two hours in circuit: it is divided into the Jewish quarter at the west end, Bîru-l-'Adzb, and the city proper, with the citadel, at the east end. There are many handsome houses, but many quarters of the town are in ruins, and the population at the present time, including the Turkish garrison of 1000 men, is scarcely over 20,000.

Jábâl-Najúm consists of sandstone rocks, through which masses of basalt have been upheaved: in some parts they form large polygonal columns. Iron pyrites, and black stones containing iron, are very abundant. Many fine agates are found in the rocks. Gypsum, alabaster, and marble are found in the neighbouring hills. The salt used at Sana'á and the uplands of Yemen is rock-salt, which is brought chiefly from Mârib, in the Jauf country. This latter district also furnishes horses.

During three of the four days that we spent at Sana'á it rained incessantly, the temperature falling to 15° Centigrade. Generally speaking, the climate of Sana'á is subject to great variations, cold nights succeeding upon hot days. Water freezes not unfrequently in winter, and the natives are obliged to use furs and sheepskins. The Turkish medical men who have resided some time at Sana'á all agree in considering its climate as very trying, and positively unhealthy.

Sana'á has been so well described by Niebuhr, Cruttenden,

Hulton, Seetzen, and other travellers, that it is superfluous to enter into details concerning it, and the more so, as with the exception of the presence of Turkish troops, I believe Sana'a is very much what it was a century ago; if anything, the town has fallen off, and the population has dwindled down considerably.

The distance from al-Hudaidah to Sana'a is about 130 miles.

Until the Turkish troops occupy the Jauf and Najrân, travelling in those districts will be fraught with danger (witness Arnaud and Halwy's journeys); hence the ordinary traveller must forego the pleasure of exploring regions so interesting from the numerous Himyaritic remains that they contain.

Leaving Sana'a we determined to return to Hudaidah by way of Kaukabân, Tawilah, Jâbal, Hâfash, and Bâjil.

We first visited Raudhah, 5 miles to the north of Sana'a. Here are the summer-houses of the wealthier Sanâwis, going across the plain in a westerly direction; we saw in the distance the village of Jadîr, and passing near other villages we reached the hills and entered the gorge of Wâdi-Thaur, in which is a walled town of the same name. Al-Wâdi is a narrow winding gorge, shut in by hills of sandstone of a reddish hue; its length must be about 10 miles. A considerable stream, which has its source in Jébal-Hâthûr, also called Jâbal Nâbi-Shâib, flows north-eastwards towards the plain, watering several miles of orchards. The Wâdi-Thaur supplies Sana'a with fruit, such as grapes, figs, walnuts, peaches, plums, apricots, pears, apples, lemons, oranges, mulberries, and quinces. There are a few date-trees, but the dates do not ripen. Najrân sends dates to Sana'a. The natives are very proud of Wâdi-Thaur, and liken it to Damascus: it certainly is a fertile and beautiful valley, with abundance of water.

From al-Wâdi we rode to Shibâm. Ascending the hills which border the valley on the west, we travelled for several hours over a stony plateau, cultivated partially with cereals. From the most elevated part of the table-land we had a good view looking west of a long range of cliffs running from north to south, and we could faintly discern on one cliff the town of Kaukabân. To the south was Jâbal Nâbi-Shâib, one of the highest mountains in Yemen (snow falling on it at times in winter). Descending we reached the plain, and at length the walled town of Shibâm, at the foot of the cliffs on which is Kaukabân. To the north, on the heights of the sandstone range, is the fortress and village of Thâllah, and beyond it, on the plain, the village of 'Amrân. The plain of Shibâm is very fertile, cereals, clover, beans, and mustard, being the chief products. There

are a few willow-trees and fruit-trees near a spring outside the town. On the face of the cliff are numerous grottoes hewn in the rock; we also noticed many in the Wádi-Thaur.

Some are inhabited, others being used for storing hay or as stables. It is impossible to say at what period these chambers were constructed, but it is probable that they date from the earliest times.

A causeway bordered with rose-bushes, ferns, nightshades, &c., leads up to the summit of the cliff, 800 feet above Shibám. Beasts of burden ascend and descend with the greatest facility, so well has the road been made. It reminded us of the Arab causeway leading to the peak of Jábál-Shamsán, at Aden. Once at the top, one soon reaches the walls of Kaukabán. This famous Arab stronghold, which surrendered to the Turks in 1872, after a siege of seven months, is built on the edge of a sandstone plateau, called Jábál-Dhála'. On two sides of the town are yawning precipices; at the bottom of one is Shibám, and of the other a ravine, called Wádi-Nái, the third side of the triangle being formed by the table-land, the only vulnerable side. The view from the heights of Kaukabán comprises the plain of Shibám, a portion of the plain of Sana'a, Jábál-Najúm, and in clear weather the minarets of Sana'a, distant 18 miles in a direct line; besides a wide table-land, the heights of Gumlan and Jábál Nábi-Sháib. Towards the south, far below, are the Haráz and several other mountains. Looking west one sees nothing but a stony table, and to the north are Jábál-Mithnary, Thallah, and 'Amráñ. The water supply of Kaukabán is inexhaustible, from the extensive reservoirs that have been hewn in the rock: rain falls very frequently. The temperature is at times very low; during our stay the thermometer showed in the middle of May only 10° Centigrade before sunrise; during the day it rose to 20°. The table-land of Dhála' must be about 6000 feet above the sea. The Turkish troops suffered much from the cold and from the frequent rains. Kaukabán is garrisoned by about 200 Turkish troops; the walls, gates, and many of the houses show that the bombardment was well sustained; the fire seems to have been principally directed on the palatial residences of the Imáms of Sana'a. About a quarter of a mile from the town, on ground commanding it, one sees the trenches and parallels of the Turks; 700 Turks who perished during the siege lie in an adjoining field. The cemetery of the town is without the walls, the graves are marked with upright tombstones, but without epitaphs: the same fact struck us at the cemeteries of Sana'a and Wádi-Thaur.

A ride of 6 miles over stony ground intersected by ravines brings

one to the head of a valley, which lower down is called Wâdi-Lâ'ah. The descent is very steep. Almost immediately the face of nature changes. The air is warm and laden with the perfume of flowers; the hillsides are covered with underwood; aloes, euphorbias, oleander, geraniums, labiateæ, ferns, mosses, &c., grow luxuriantly; instead of vultures, one hears and sees many a songster—in short, after wild, bleak, and stony deserts, one is again in Araby the Blest.

Jâbal-Mîswar bounds the opposite side of the valley, the road to Tawilah being carried along one of the spurs of Jâbal-Dhâla'. Tawilah is a walled town with fortresses on three of the seven basaltic masses, which rise to the height of 50 to 200 feet above the town. It was in former days a stronghold of the skaikhs of Kaukâbân. The town overlooks a portion of Wâdi-Lâ'ah, and we could see on the slopes coffee-plantations and several villages. Looking south one sees range after range of mountains running from east to west. Jâbal-Burâah in the distance, then Harâz, al-Khaimah, Sarâ, Háfash, and Milhân. We next rode to Rujûm, 15 miles to the south of Tawilah, and several hundred feet lower. The country is well-cultivated, the sides of the hills being terraced with stone walls wherever there is earth. The fields are ploughed with oxen, which are humped like the zebu of India. Thousands of cattle have perished in consequence of a murrain, which during eight years has committed dreadful ravages throughout the hill districts of Yemen.

Rujûm is a walled town built on a basaltic rock that rises above a marshy plain; twice a week a market is held in the plain. 15 miles from Rujûm is Muhwit, a walled town with a Turkish garrison. The Jewish quarter is below the town. The climate, from the position of the town on the slope of a mountain, is cool. A spring of water in the neighbourhood is led into a few tanks, which the natives use for bathing. A bath in the cold spring water of Muhwit is supposed to cure a number of diseases. It was recommended to us for intermittent fever.

It had been our intention on leaving Muhwit to ascend the eastern slope of Jâbal-Háfash, make a halt at Safakain, a Turkish military station, descend the western slopes to Rubâ'a'h, and thence to Bâjil. We might have seen many coffee-plantations, the culture of kaat, *Celastrus edulis* (a plant whose young shoots are extensively chewed throughout Yemen, in the same way and with the same advantages as the natives of Peru use the coca plant), besides much that is interesting. But we were so weakened by a fever caught at Rujûm, that we chose the easier route to Bâjil. After a long and steep descent we came to Wâdi-Mûhdirah, through which flows a stream of water teeming with fish, very like trout.

This stream rises in Jâbal-Hâfash, and flows in a southerly direction; in some parts it is bordered with stately trees, and there are also a few coffee-plantations. Leaving the stream and passing the village of Sarâ, we halted at Ghaffâf, and on the following day rode to another market village called Sûku-l-Juma'ah, at the foot of Jâbal-Sarâ, with Jâbal-Hâfash to the west.

The valley between the two mountains is called Wâdi-Ghaffâf, and it extends for some 15 miles in a south-westerly direction, till it joins the Wâdi-Hârrah, at Suku-l-Khamis. It is well wooded with tamarisk, hennah, nabuk, tamarind, and acacia trees, and there are many fields of dhoura and dûhn. We were now in the hot valleys bordering on the Tihâmah. The natives were no longer the pure Arabs of the mountain districts, but a mongrel race, of an olive complexion, some of them with woolly hair or thick lips; their Arabic differs much from that spoken by the pure Arabs, containing as it does many foreign words. The inhabitants of the Tihâmah belong to the same race. They are somewhat despised by the Arabs. The women when out of doors wear hats like those worn by Welshwomen, made of palm-leaves, and some of the men wear helmets made of the same material.

Just before reaching Sûku-l-Khamis we forded a considerable stream, the Sardûd. We were told that it rises at the foot of Jâbal Nâbi-Shâib, flows through one of the gorges in the Hâraz Mountains, called Wâdi-Bishah, next along Wâdi-Hârrah, and then along Wâdi-Sardûd. It drains the watershed of Nâbi-Shâib, Hâraz, al-Khaimah, and Jâbal-Sarâ, and other mountains, and contains in consequence a large body of water. From Khamis we went to Hamrâ along Wâdi Sardûd. The first half is a narrow winding gorge shut in by granite mountains. The bed of the stream is so narrow that one is obliged to ford the stream many times; after heavy rains the stream is so broad and violent, that communications with Hamrâ become impossible. At the second half one emerges from the hills and reaches a plain bounded to the north by Jâbal-Hâfash, but chiefly by Jâbal-Milhân. From Hamrâ the river flows west through alluvial soil, till it reaches the Tihâmah at a village called Zhúbah; after the summer rain it sometimes flows to the sea to the north of al-Hudaïdah. Leaving Hamrâ and the Sardûd we went due south through Wâdi-Azzân to Bâjil, a distance of 12 miles. From Bâjil we revisited Kuttây and Marâwah in the Tihâmah. This village has a large market twice a week, at which mangoes, bananas, kât, dhîrrah, milk, and the produce of the neighbouring hills are sold; besides rice, tumbak, spices, &c., which are brought from al-Hudaïdah. A Sayyid resides at Marâwah, who is held in

such esteem that people come from long distances to converse with him. The Turks honour him so much that the village of Marâwah is exempted from all taxes. A four hours' ride brought us back to al-Hudaidah again. Thus from the uplands of Sana'a and Kaukâbân, the zone of cereals, we had passed to the zone of coffee, and thence to the tropical lowlands and Tihâmah, the zone of *dhûrrah*, cotton, and date-trees, and from it to the desert shores of the Red Sea.

The PRESIDENT said there could be no doubt that a great deal of interesting archaeological information was to be derived from the country through which Dr. Millingen had travelled. Remains were to be met with of tribes who appeared to be of African origin, and who were still mixed with the Arabs of the district, speaking a different language, and in many respects being entirely distinct. Whether they or the Arabs were the older inhabitants, or whether they were the remnants of a great Ethiopian empire which formerly extended over that part of the country, were as yet unsolved problems. Very little was known of their language, or of the antiquarian questions which might be illustrated by the monuments of the races which had passed away, and by the inscriptions, specimens of which had been sent home, and were now in the British Museum.

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PROCEEDINGS  
OF  
THE ROYAL GEOGRAPHICAL SOCIETY.

[ISSUED MAY 29, 1874.]

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SESSION 1873-74.

*Eighth Meeting, 9th March, 1874.*

The RIGHT HON. SIR H. BARTLE E. FRERE, K.C.B., K.C.S.I., ETC.,  
PRESIDENT, in the Chair.

ELECTIONS.—*Dr. Altschul, M.A., etc.; Dr. George K. Barton; Rev. J. Cave Browne; Arthur James Dadson, Esq.; Viscount Harberton; Reader Harris, Esq.; Lieut. John Hill, R.E.; Frederick William Lawrence, Esq.; Edmund Giles Loder, Esq.; Lieut.-Colonel McMahon; Daniel Meinertzhagen, Esq.; Adolphus W. Moore, Esq.; Richard Nathaniel Philipps, Esq.; Albert E. Scott, Esq.; Colonel Ainslie Stewart; Gilbert M. Stewart, Esq.; Walter Spencer, Esq.; Captain Joseph Thwaites; Ernest Tinné, Esq.; James Hume Webster, Esq.; Joseph Wilkinson, Esq.*

*His Excellency Mirza Malcom Khan, the Persian Minister, and Don Manuel Pardo, President of the Republic of Peru, were elected Honorary Corresponding Members of the Society.*

PRESENTATIONS.—*Reader Harris, Esq.; G. O. Bridgeman, Esq.; General R. F. Copland-Crawford, R.A.; Thomas Challen Greenfield, Esq.; Captain J. E. Hunter, R.N.*

ACCESSIONS TO LIBRARY FROM FEBRUARY 23RD TO MARCH 9TH, 1874.  
—‘The Depths of the Sea.’ By C. W. Thomson. 1873. By purchase. ‘A Whaling Cruise to Baffin’s Bay.’ By A. H. Markham. 1873. By purchase. ‘Indian Remounts.’ By G. Elliot. Bombay, 1874. Donor the author. ‘Résultats scientifiques des Explorations de l’Océan glacial à l’Est de Spitzbergen en 1871.’ Par C. Grad. Paris, 1873. Donor the author. ‘Australia and New Zealand, 1874.’ By S. W. Silver. Donor the publisher. ‘The Heart of Africa.’ By G. Schweinfurth. 2 vols. 1874. By

purchase.' 'Growth of Commerce,' and 'A Manual of Recent Commerce.' By J. Yeats. 2 vols. 1872. Donor the author. 'Knap-sack Manual for Sportsmen on the Field.' By Edwin Ward. 1872. Donor the author. 'Des Vents observés dans l'Atlantique nord.' Traduit par M. de la Tour du Pin. Paris, 1873. Donor the author.

ACCESSIONS TO THE MAP-ROOM SINCE THE LAST MEETING OF FEBRUARY 23RD, 1874.—Map of Asiatic Russia, showing the route of Grafen Hans Wiltschek. Map of Western Australia, showing the routes of Colonel Warburton and Mr. Gosse. Chart of the South-East Part of New Guinea. By Captain Moresby, R.N. Map of Disko. By Messrs. J. G. Rohde and K. J. V. Steenstrup. These 4 maps presented by Dr. A. Petermann. Ordnance Survey, 413 sheets and 64 area books. Presented by the Chief Commissioner of Works, through Sir H. James, R.E., Director.

The following papers were read:—

1. *Across the Andes from Callao.* By THOMAS J. HUTCHINSON,  
F.R.G.S., ETC.

THE most masterly sketch, which I have read, of the programme to be adopted by Peru in her great system of railways—initiated more than fifteen years ago—is contained in a pamphlet, written by the existing President of the Republic, when he explored the province of Jauja in 1861.\* In that he speaks of the three great lines to cross the Andes:—first, the track suggested from Chala, which was afterwards changed to Mollendo, to go through Arequipa, and Puno to Cuzco; second, the one now in progress from Pacasmayo by Magdalena to Cajamarca; and the third, to Junin, which was to include the provinces of Jauja, Tarma, Huanuco, and Huancayo—together with the district of the silver mines of Cerro de Pasco. It is to the last mentioned, which comprises the stupendous works already done, on the road from Callao to the Oroya station, that this paper chiefly refers.

In the *brochure*, just alluded to, the author expatiates on the riches of the Junin department, as being more worthy to excite the attention of the Peruvian Government, as well as of capitalists and speculators, than any other part of the Republic. He enumerates the peculiarities of each of the provinces contained therein—describing their geographical relations with one another, as with the rich valley of Chanchamayo, and more especially with the province

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\* Estudios sobre la Provincia de Jauja, por Don Manuel Pardo. Lima, Imprenta de la Epoca, 1862.

of Jauja, which was the particular object of his study. The valley of Jauja he describes as a garden, exceeding forty square leagues, or above three hundred and sixty square miles in extent, variegated by picturesque residences, surrounded by trees, and its magnificent river set off by the charming vegetation on the hills that skirt its course. The mineral riches of the silver mines of Cerro de Pasco ; of the quicksilver at Huancavelica ; of the copper at Tuctu-Cocha, as at Moro-Cocha, are likewise described. In the last-named place coal has been found, of which Don Manuel writes as equal to that of Newcastle. The distance, as the condor (not the crow) flies from Lima to Jauja, is above twenty leagues, or a little over sixty miles. But the road which mules had to travel was beyond fifty leagues, or more than a hundred and fifty miles. The valley of Jauja is seventeen leagues beyond the highest peak of the Andes to be crossed in the transit to it. We can therefore scarcely wonder that the freight of goods on this journey, at the time indicated, was charged 80 dollars per ton, or "from Lima to Jauja four times more than it would cost from Callao to Liverpool or China."\* Then he goes on to prove what beneficial results must ensue from the introduction of a railway into these regions, and with those points discusses the peopling of the Amazon Valley. The two grand ideas entertained by Señor Pardo, in reference to the three lines of railways to which I have alluded were, that, in conjunction with the development of the mineral wealth of Peru, they should introduce colonisation into those parts of the Amazon valleys which belonged to his country, as on the sea coast they might be joined together by a line running parallel with the Pacific Ocean. The last-named was originally suggested by Mr. William Wheelwright, whom Señor Pardo appropriately designates, "the Fulton of South America." But this has been better supplemented by another and more practical institution, originated and founded by the same Mr. Wheelwright, namely, the excellent service of the Pacific Steam Navigation Company. It effects an almost daily communication and intercourse, along the whole shore of the Southern Pacific, from the Straits of Magellan to the Isthmus of Panama. And although commencing its career in 1840 with only two steamers—the *Chile* and the *Peru*, it has now over sixty vessels—one of the finest fleets of merchant squadrons in the world.

So far back as 1856,† however, Señor Malinowski had been commissioned by the Government to give a report on the works of

\* Op. cit., p. 23.

† 'Documentos Legislativos sobre el Establecimiento y la Mejora de las Vías de Comunicación en el Perú.' Lima, 1856.

public utility in Peru; more particularly on the roads of communication along the coasts and to the interior.

In his report on the Central Transandine Railway Line, Señor Malinowski observes: \*—"On a simple inspection of the map we can notice the importance of the position, called Oroya, to satisfy all the exigencies of a general head-quarters position at the other side of the Cordillera. From thence branches can be made in three principal directions, and evidently the most direct way from Lima to Oroya, that by the valley of the Rimac, is the preferable one."

The Oroya line, as well as the two others alluded to in the first part of this paper, are all in the hands of Mr. Henry Meiggs, a citizen of the United States, who may be entitled "the Railway King of Peru." The contract for the Oroya line was given to him on the 18th of December, 1869, with the conditions that the road should be completed and its equipments finished in six years from the date of signing, the price to be 27,600,000 soles † (about five millions of pounds sterling), in Peruvian bonds—the work to be done in pursuance of the details and specifications laid down by the government engineers.

The principal points of interest in this railway are contained in a report by Mr. McGhee, one of the engineers, of which he has furnished me with a copy, and liberty to use it at my discretion. He has likewise supplied me with diagrams of the peculiar "developments," as they are entitled, by which the ascents of the Cordilleras are effected. "The ascent from Callao to Lima," he tells us, "of  $7\frac{1}{2}$  miles, is 450 feet. From Lima to Chosica, 26 miles farther, the grades do not exceed two and a half per cent. The 4 per cent. grades commence here, but do not make it necessary to leave the valley of the Rimac until San Bartolomé, 13 miles farther, is reached."

Starting from Lima the first 20 miles of the road, to between the stations of Santa Clara and Chosica, the track has no perceptible elevation. Indeed, the gradients here do not exceed 1 to  $1\frac{1}{2}$  per cent. As we approach the latter place we get into the valleys, or rather ravines. On either side we are hemmed in by lofty mountain masses, in which are visible rents made by the earthquakes, whilst in the low grounds on the river-banks are many huge boulders, some of them from 80 to 100 tons in weight, which have been hurled down in some of the great convulsions.

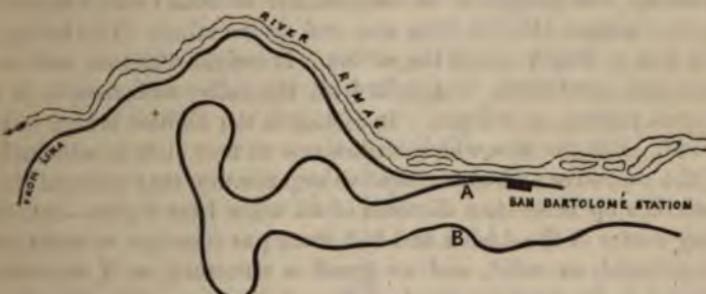
From Chosica, passing Pedro Mama, and to the next station of

\* Op. cit., p. 13.

† By a pamphlet published in Lima this year on the Railways of Peru I observe that the effective value of this amount is now 21,804,000 soles, owing, no doubt, to the unaccountable and perfectly foundationless depression in Peruvian bonds.

Coca-Chacra, the line crosses the Rimac twice—first from the left side to the right over a small bridge at Cupiche, and then coming back from the right side to the left by another iron bridge at Corocona. About the neighbourhood of these two bridges originated the dreadful fever which caused such terrific mortality amongst the navvies, and other working hands, more particularly the Chilians, in 1870 and 1871. This fever was of the intermittent form, although scarcely possible to have its origin in marsh miasma, nothing of which is known to be existent hereabouts. No swamps are in the neighbourhood, and the locale is higher up than any of these positions said by Carrière and Blake\* to be the limits of altitude for marsh fevers in tropical countries. I am disposed to attribute it to what is mentioned in a late work on Malaria, by Dr. Oldham, namely, "the rapid extraction of animal heat by lowering the vital powers." Such a process as this is easily effected amongst people who lived as the labourers in question, working all the day in a hot sun, drinking quantities of pisco (native brandy) in the evening, and sleeping in the cold, damp valleys,—as often on the moist ground, and uncovered, after their gambling, as in the comfortable sheds, prepared for them by Mr. Meiggs.

From Chosica, 2800 feet above the sea, to Coca-Chacra, at an altitude of 4558 feet, is a run of 11 miles, and two miles farther on is the station of San Bartolomé or Urabamba, at a height of 4910 feet above sea-level. "I know of no other road," says Mr. McGhee, "that, starting from the sea, rises to this elevation in 46 miles' distance. It was thought best to take to the mountain side here to gain elevation by a development, which was done as shown in the following reduced plan.



" From A to B we have  $2\frac{2}{3}$  miles—these two points are 550 feet

\* This estimate is that malaria never ascends beyond—in Italy, from 400 to 500 feet; America (Apalachia), 3000 feet; India, 2000 to 3000 feet; West Indies, 1400 to 2200 feet; California, 1000 feet; Western Africa, 1500 to 2000 feet.

apart, horizontally in a direct line, and 435 feet apart, vertically." From this station, it may be observed by the diagram, the first retrograde movement begins; Mr. McGhee thus explains it:—"As soon as the line has to take to the side of the mountain, some very heavy cuts and fills are met—the sides of the Cordillera being very steep. From B to Verrugas Bridge,  $2\frac{1}{2}$  miles further, the line is from 400 to 500 feet above the valley, passing through two short tunnels (one of them on a curve of 120 metres' radius). In this passage there is a piece of embankment 340 feet in length, containing over 90,000 cubic yards of material—the slope on lower side extending to the valley over 400 feet below. The cutting is mostly rock, the remainder being a kind of conglomerate gravel, which is very hard. At this embankment the line passes through a cut 165 feet deep over that structure, and into another cut 95 feet deep. These are centre heights, the heights on one side being much more. At Verrugas Bridge the first approach is through a cut 105 feet deep, and across the bridge, 262 feet high, the road enters a cut through the solid rock, which is 60 feet deep."

I have given this extract from Mr. McGhee's report to show the stupendous nature of the work which had to be here executed.

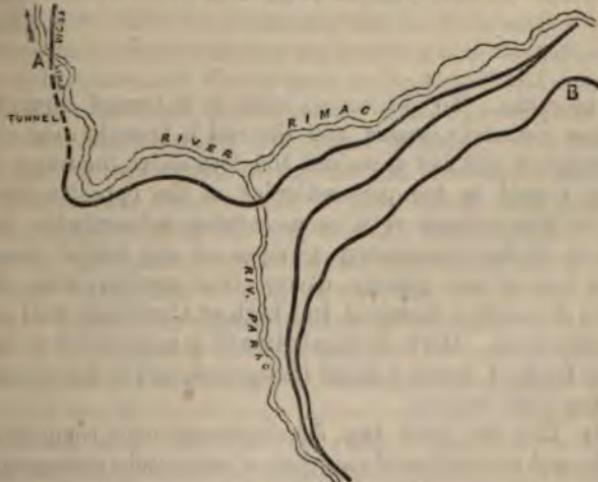
On the ascent from San Bartolomé to Verrugas, the line passes by a collection of houses, with an old chapel, situated on a plateau that offers a charming contrast to the rugged rock scenery through which we have been previously journeying; for here are lofty trees, and all the luxuriance of tropical vegetation in gardens of bananas, guavas, and chirimoyas. The bridge over the Verrugas, to cross the ravine, is what is called a "Fink truss," the small rivulet beneath being scarcely perceptible as we look through the girders. The longest of its longitudinal sections (which comprise four) measures 114 feet from one end to the other. The bridge is 525 feet in length across the ravine. It weighs 600 tons, and, as I have just mentioned, its height from the valley underneath, in its central portion, is 262 feet. In fact, it is the highest bridge in the world. But the idea which strikes one at first view is admiration of the executive and administrative organisation that brought these materials up here—to a distance of 52 miles from Callao—into the very centre of the Andes, and had them put together, to constitute as graceful, as solid, and as grand a structure, as if they were erected in the neighbourhood of Regent Street, or of the New York Broadway.

Between Verrugas Bridge and Surco is a run of 3 to 4 miles, the chief noticeable work being the Cuesta Blanca Tunnel, through a precipitous side of the mountain which is at this part 575 feet

above the bed of the river. The difficulties to be overcome here may be imagined, when we consider what Mr. McGhee tells us, that "the line at this point, as in many others, could not be surveyed. Triangulations were made to study it, and locate approaches, and the course of the line directed as the work progressed. The rock in this tunnel was very hard and tough, scoring glass like a diamond. Here the diamond drill worked well. And the Rimac, with its fall of 200 to 400 feet per mile, furnished a magnificent water power alongside of all the tunnels, for compressing air except at the summit tunnel.

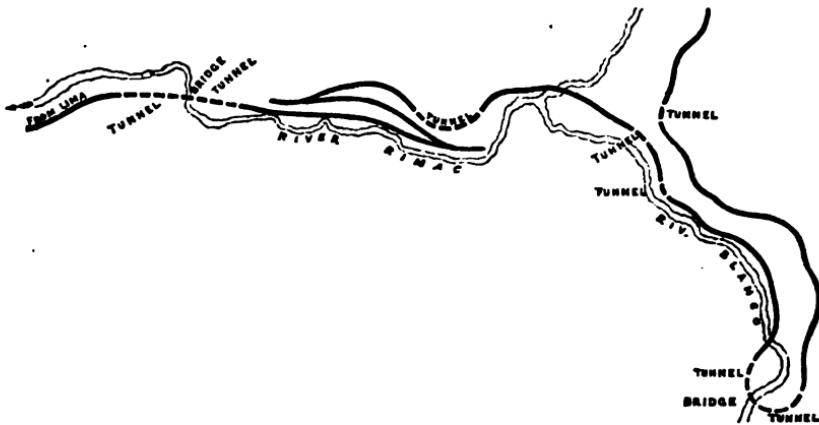
Surco is a miserable village in the province of Huarochiri. Up to the period of the railway invasion it constituted one of the resting places for travellers on the journey between Lima and Jauja. From Surco (6655 feet above the sea-level) the line crosses again to the right bank of the river by a bridge at Uccuta. Thence going beneath the San Juan Hospital, it runs over the river once more to the left side, and makes a retrograde motion from Mayuyaca as if bent on returning to Lima. But this is only a pretence, for again it wheels round about at Sacrape, through a tunnel of 395 feet radius, and thence creeps up through the district of Moyo to Matucana, having in its last twelve miles accomplished an ascent of over 1100 feet, for here it is 7788 feet above sea-level.

From Matucana, on through tunnels, over bridges, and across viaducts, still mounting though zigzagging. It will be seen how this is done by the ensuing diagram, where an air-line of a mile and a half from A to B, requires 5 miles of railway track laid



down to accomplish it. In parts of this development, Mr. McGhee tells us that, "only for benches or shelves put in the rocks, such places would have been inaccessible to bipeds."

The last mentioned development having been between Matucana and San Mateo, we find ourselves now entering into the true region of the condors. From Matucana to San Mateo is a distance of about fifteen miles by rail, in which an ascent is gained of nearly 3000 feet, so that here we find ourselves at an altitude of 10,530 feet above the sea. The most remarkable development in the whole line is that which we have now to consider where "the river passes for some distance between two walls of rock that rise perpendicularly to heights variously estimated at from 1000 to 1500 feet." Hence it comes rushing and roaring down a



flight of rocks. To get across here is a tunnel through those enormous mountain masses, and the rail is brought over the river on a bridge of 160 feet span, and 165 feet above the water to enter another tunnel in the perpendicular at the opposite side. The scene in this passage must be something indescribable, with the sensation of that momentary glimpse of sky whilst crossing in mid-air out of one gloomy cavern into another, with the bare glimpse of nearly a thousand feet high of Cordillera wall towering above the train. Here, in an air-line of a mile and five-eighths, a railway track of nearly 5 miles is required, and in this short length there are eight tunnels.

After this we have two developments—one comprising two tunnels, and a considerable amount of retrograde movement below and above Chicla, whilst the other brings us through the tunnel

at the topmost height of the Andes, and down to the Rio de Visca, which is a tributary of the Amazon. "The line from Casapalca," says Mr. McGhee, "across the summit and to the Rio de Visca, although quite straight between certain points as to its general direction, is made up principally of a succession of sharp curves." The tunnel by which crossing is to be made through the mountain is distant 104½ miles from Lima. Its altitude is 15,650 feet. It is to be three-quarters of a mile in length, and the highest portion of mountain above it is 680 feet.

From the exit of tunnel at the other side the distance to Oroya is about 30 miles—Yauli being intermediate at about half the journey. The grading is all finished here, and is only waiting for the material of rails and bridges to put *in situ*. "Once the tunnel over the Andes is crossed," observes Senor Malinowski, "the line has little or no difficulties to encounter." This is indeed a consolation after all the hard work which was necessary to climb up to the regions of perpetual snow.

That the government of Senor Don Manuel Pardo does not mean allowing this railway to be limited to Oroya is evident from the fact of a law passed by Congress on the 30th of April last (1873), in which, amongst other lines, it is authorised to construct a railway from Oroya to Pasco (already mentioned as the great silver district), with a line from Oroya to Janja and Huancayo. That it will eventually be extended through the valleys of Chanchamayo, Moyobamba, Loreto, and the many rich stretches of land that constitute the small world contained in the Amazon district, I have not the slightest doubt. The latest summary which I have read of what has been done and is doing amongst the tributaries of the Father of Waters, is an excellent and clearly written article in 'Ocean Highways,' by Lieutenant Don Juan Salaverry, of the Peruvian Navy.

The other line to Caxamarca is in rapid progress. In a couple of years more we may expect to hear of the Peruvian President going on a trip from Lima on the Oroya Railway, and passing through the tunnel beneath the lofty summit of the Chuquichuco, stretch out the right hand of fellowship, not only to all the nations of the Amazon Valley, but to those at the other side of the wide Atlantic, into which the mighty waters of the great river are discharged. The civilised world will then give its meed of tribute to the intelligence and wisdom of the Peruvian Government, as to the indomitable energy of her great railway contractor, Mr. Henry Meiggs, who has, within the last few years, done more for Peru than all the monarchs, chiefs, or conquerors dwelling in the land from creation's dawn down to the present time.

*2. Railroad and Steam Communication in Southern Peru.* By  
CLEMENTS R. MARKHAM, C.B., F.R.S., Secretary R.G.S.

WHILE the railway described by Mr. Hutchinson will connect the capital of Peru with the valleys of Tarma and the mines of Cerro Pasco, the great work which has just been completed in the south of Peru will bring the mineral wealth of Bolivia and the rich products of the eastern valleys into direct communication with the Pacific ports.

The central region of the Peruvian Andes presents an aspect very different from that to the south and on the Bolivian frontier. In the centre the space between the Maritime and Eastern Cordillera is comparatively narrow ; it is broken up into deep, worn valleys and profound ravines, where wheat, maize, and even sugar-cane, are grown in the different zones of elevation. But the southern part of the Peruvian Andes and the northern portion of Bolivia present a very different character. From the Vilcañota knot, the Andes separate into two distinct chains, namely, the Maritime Cordillera and the Eastern Andes, which includes the loftiest peaks in America. The region between these two ranges contains the great lake of Titicaca, and consists of elevated plains intersected by rivers flowing into the lake, at a height never less than 12,000 feet above the sea. It is usually called the Collao, from one of the tribes which occupied it in ancient times. The surrounding mountains contain inexhaustible stores of copper and silver, the plains afford pasture for large flocks of alpacas, while the inner slopes of the Eastern Andes produce the best Peruvian bark, coffee, cocoa, coca, arnotto, and are watered by streams containing gold-dust in large quantities.

It has long been an aspiration of the best Peruvian statesmen to see all this wealth borne over Lake Titicaca by steamers, and across the frozen plains of the Maritime Cordillera by some more expeditious means than is afforded by the backs of llamas and mules. Nearly thirty years ago Don Manuel Costas, the present Vice-President of Peru, made an attempt to place a small steamer on the lake. He foresaw that, if this could once be done, a most important trade would spring up, which would give fresh life to the people of this classic land. All the products of the Bolivian forests—timber, chinchona-bark, chocolate, coffee, coca, fruit and arnotto—would be conveyed to Puno ; and European manufactured goods, the aguardiente of the coast valleys, and the sugar of Abancoy, would be sent in exchange to the Bolivian ports. There would also be a brisk trade in wool, silver, and copper, and a

traffic in provisions of all kinds between the Indian villages near the shores of the lake. Timber in vast quantities might be felled and sawn in the forests of Caravaya, and floated down the rivers during the rainy season, which, with the coal on the island of Loto, would furnish supplies of fuel. A railroad across the Andes, connecting the steam navigation of the Titicaca Lake with the ports of the Pacific, was a stupendous undertaking which, even 15 years ago, was scarcely dreamed of by the most enthusiastic speculator.

Yet the whole of these schemes have not only been undertaken, but are now completed and actually in working order.

The railroad from the port of Mollendo to Arequipa has been completed some years. Mr. Meiggs accepted a contract to construct a railroad across the Andes, from Arequipa to Puno, for 32,000,000 soles (6,400,000*l.*), or 29,500*l.* a mile. The cost of transport, labour, materials, and provisions was, of course, enormous. The distance from Arequipa to the shores of Lake Titicaca is 217 miles, and the works were commenced on June 7th, 1870.

After leaving the city of Arequipa the line crosses the River Chilé by a superb viaduct 1505 feet in length and 70 feet above the river-bed; and there are three other viaducts of equal magnitude, all constructed in the United States, and conveyed to their sites with infinite difficulty. Embankments of various heights, from 50 to 500 feet, are numerous, and, in some cases, the rough and steep slopes are overcome by reverse tangents. In one place there is a cutting, 84 feet deep, on the side of a precipice, with the roadway 1000 feet in perpendicular height above the valley. The longest tunnel is only 300 feet from mouth to mouth. Extraordinary difficulties had to be overcome, as may well be supposed when the inaccessible nature of the country is considered, the long distances without water, the heavy snowstorms, the absence of roads, and the intense cold of the loftier portion. From Arequipa to the baths of Yuva, a distance of 17 miles, there is no water, and up to this point the costly expedient was adopted of conveying it to the works on mule-back. The same thing was necessary from Caniaquas for 26 miles. From 4000 to 5000 labourers, chiefly Chilians and Bolivians, have been constantly employed during three years and a half, and on the 1st of January, 1874, the first locomotive reached the shores of Lake Titicaca. The highest point on the old road from Arequipa to Puna is 15,590 feet above the sea, and that of the line selected for the railway cannot have been much less.

Meanwhile active steps have been taken to establish steam

navigation on Lake Titicaca. In 1861 the Peruvian Government ordered two screw steamers in London (20 tons, 40 H.P.), called the *Yaravi* and *Yapura*, which were sent out to the port of Arica, thence to Tacna by rail, and, finally, the pieces were carried across the Andes on the backs of mules to Puno. But several pieces were lost, and the project remained in abeyance until 1868, when Captain Melgar, of the Peruvian Navy, was appointed to put together and launch the steamers. He set to work with zeal and energy. Those who have crossed the Andes, and seen the total absence of all resources at Puno, can form an idea of the difficulties that have been overcome by Don Manuel Melgar. He had to build a factory and a stone mole, and to bring up all the workmen and materials from the coast, the lake being 12,000 feet above the sea. The *Yaravi* was launched in June, 1871, and the *Yapura* on the 19th of March, 1872.

Their presence on these inland waters, together with the railway, will revolutionise the commerce of the surrounding provinces, knit the people of Peru and Bolivia together by common interests, and put new life into the inhabitants of the shores of Titicaca, the sacred lake of the Yncas. Markets and rapid means of communication having been secured, the trade of this region may be expected to increase rapidly on all sides. The face of the country will be entirely changed; the people, finding new wants, will become more civilised, and Puno, instead of a town with empty, silent streets and half-a-dozen reed *balsas* at its anchorage, will soon be a flourishing and busy port. When I was there, now nearly 14 years ago, these prospects seemed far distant. But now, thanks to the energy of the Peruvian Government, and of the great contractor Mr. Meiggs, they seem to be close at hand.

The cause of geography will be wonderfully advanced by these undertakings. At present there is no complete survey of the basin of Lake Titicaca, which, in some important respects, possesses special geographical interest. Lake Titicaca covers a superficial area of about 2500 square miles, being 100 miles long by 35 wide, and the surface is 12,196 feet above the sea. It is divided into two parts by the peninsula of Copacabana, the south division being 8 leagues long by 7, and united to the larger portion by the Strait of Tiquina. A number of rivers, which are swollen and of considerable volume during the rainy season, flow into the lake; and the water is carried off by the drain or *Desaguadero*, which, after a course of 160 miles, empties into the salt lake and swamps of Pavia or Aullagas.

The *Desaguadero*, connecting Lake Titicaca with the Aullagas,

is a very remarkable feature. At this great elevation land vegetation is stunted and scanty, but in the waters of the lake there are acres of tall rushes. The constant east winds blow all the dead rushes to the western side, where they mix with the living beds and form a dense tangled mass. Out of them flows the drain, with the surplus waters of the lake, and so, by a channel 160 miles long, connects Titicaca with the salt swamps of Aullagas. Davalos y Figueroa, a native of the country, who wrote in 1601, even speaks of the whole as one lake, saying that in one part, where it is called the Desaguadero, or drain, it becomes very narrow.

These features cannot fail to remind the Meeting of the interesting discussion, in which Sir Samuel Baker took part on January 26th, on the subject of the supposed connection between the African lakes Tanganyika and Albert Nyanza. The surface waters of Titicaca, like those of Tanganyika, are fresh; and, in Sir Samuel Baker's view, Tanganyika is connected with the Albert Nyanza, which is at the same level, by a channel analogous to the Desaguadero, flowing from Titicaca to the Aullagas swamp.

The Aullagas, which is the final receptacle of all the drainage of the Titicaca basin, is of course utterly unlike the Albert Nyanza, because it has no outlet and is surrounded by Cordilleras of the Andes. It is salt, but it has always been doubted whether the large volume of surplus water flowing along the Desaguadero can be disposed of by evaporation alone. Cieza de Leon, an accurate and trustworthy old soldier, who was in Peru shortly after the conquest, and wrote in 1553, mentions a report that, in some of the coast valleys of Tarapaca, there were streams which were believed to be the waters of Lake Aullagas, opening for themselves a way through the bowels of the earth. In his recent exhaustive report on the Tamarugal plains, in the Tarapaca province, Don Miguel Valle Riestra suggests a similar explanation, namely, that the waters of Titicaca, after draining into the Aullagas Lake, find their way by filtration to the lower level of the Tamarugal.

I have referred to these points in order to indicate how much there is of real geographical importance and interest which still awaits investigation in the region now at last brought within easy reach of the sea coast by a railroad. A thorough survey of the great lake of Titicaca, and of its whole drainage area, is still a desideratum. Pentland went round the lake and fixed numerous positions, many years ago, but his was only a route survey; and D'Orbigny mapped the southern shores of the lake. When I first crossed this region, my duty obliged me to follow very much in the track of Pentland; and my latitudes and hypsometrical observa-

tions agreed satisfactorily with his, my heights being a few hundred feet less. But in returning, as soon as I went off Pentland's track, I came upon new features. Among these is the lake of Arafa, north of Titicaca, which is not on Pentland's map, though it is mentioned by Castelnau. Captain Melgar, the introducer of steam navigation on Lake Titicaca, has made a survey of the coast from Puno to Jeli, and also confirms the accuracy of Pentland's observations for latitude. He has carefully examined the islands on the lake, especially that of Titicaca, the beautiful sacred island of the later Yncas, where artificial terraces, full of flowers, rise from the water's edge, tier above tier, to the hill tops, irrigated by channels drawn from the royal bath. All these classic spots around the sacred lake will now be explored and correctly mapped; and we shall at last get an accurate knowledge of this, the most interesting region, next to the Cuzco Valley, in all South America.

The valleys and wide forest-covered plains to the east of the Andes, in Caravaya and Bolivia, will also be explored. Beyond the work done by Don Antonio Raimondi and by myself, the vast and rich province of Caravaya is, so far as accurate geographical data are concerned, unmapped and unknown. Its wealth is enormous and inexhaustible. Its rivers diverge to the point in the vast South American wilderness where Colonel Church is so ably and resolutely working to complete a railroad round the rapids of the Madeira. Its more complete exploration will be a memorable geographical feat.

Now that the Peruvian Government has provided the means of rapid communication from the coast to the interior, its enlightened President, Don Manuel Pardo, has resolved to invite European explorers to judge for themselves of the resources of the ancient empire of the Yncas. An important decree was issued at Lima on January 13, 1874, enumerating the lines of railway that are now actually open, as well as those in progress.

1. From the port of Ylo to Moquegua.
2. From the port of Mollendo, by Arequipa, to Puno.
3. From Pisco to Yca.
4. From Callao to San Mateo (on the way to Oroya).
5. From Chimbote to Taquilpon.
6. From Pacasmayo to La Viña (on the way to Caxamarca).

The decree announces that, as the districts traversed by these railways abound in mineral wealth, it is desirable to bring to the notice of European enterprise the character and extent of the riches to be found within the territory of Peru, and the means of communication which place these riches within the reach of private

enterprise. With this object, lithographed plans of the Peruvian railroads, accompanied by sketches of the most prominent engineering works on them, and brief descriptions, are to be published in English, French, and German. Collections of samples of the principal minerals and coal found in the districts traversed by the railroads are also to be made in triplicate, by Don Antonio Raimondi, the State Geologist, and placed on exhibition in London, Paris, and Berlin.

The Fellows of this Society will heartily applaud the action thus taken by the Peruvian Government; for not only will it at once supply us with a large amount of new geographical information, but it will tend, in its results, to the mapping and exploration of regions now little known, but which yield to none in the world in interest and importance; whether we regard their physical structure, the magnificence of their scenery, the grand scale on which nature has worked within their limits, or their inexhaustible riches.

The PRESIDENT said that those who were well acquainted with the principal passes of the European Alps might form some idea of the difficulties which had been surmounted by railway engineers in Peru, in carrying the line over an altitude higher than the highest Alpine passes, which had just been described.

Mr. HUTCHINSON said that the most eloquent written description could scarcely convey any idea of the wonderful masses of rock through which the Peruvian railways have been made, or of the equally marvellous engineering work which had overcome the difficulties as they presented themselves.

His Excellency Senor DON PEDRO GALVEZ (Peruvian Minister) said it was to him a remarkable spectacle to observe a scientific society like this taking so much interest in the progress of a distant country. It had been at all times the noble object of science to sacrifice time and labour to studies which, although they do not produce any immediate advantages to those who undertake them, create for humanity fountains of prosperity in the future. We had the examples of persons who have devoted their lives to geographical discovery or study, and such persons he thought merited the title of benefactors of humanity. As regards Peru, the authors of the papers they had just been listening to had devoted a considerable portion of their lives to researches in that country, the results of which were embodied in works which have obtained a well-merited reputation. Mr. Markham had treated in the most practical manner the geographical questions, in connection with the actual condition of nations, and had thus obtained, not simply a distinguished place amongst the geographers of his country, but had also won in the New World the estimation and gratitude of that continent. Mr. Hutchinson, also, during the intervals of his official duties, had been enabled to devote a considerable portion of his time to the study of Peruvian geography and history. He would honour, then, in these individuals, all the members of a society whose object is the study of all parts of the world, free from every feeling of selfish interest. But it was also his duty to thank this meeting in a special manner for the interest with which it had listened to everything that had been said with reference to Peru, the progress of its public works, and the administrative career of its Government. Fulfilling its duty, and responding to the aspirations of the country, the Government of Peru was employing every means to stimulate

activity in all branches which could contribute to its general progress. Railways had occupied the principal attention of the Government, and they had already progressed considerably, as was shown by the fact of there being now 1056 miles of line completed; and as many more would be completed within the next two years. The great Cordillera had been crossed in different parts, and communication between the rich localities of Peru would facilitate their development, and encourage reciprocal internal and external commerce in Peru. But railways were only a means of transport, and our thoughts must necessarily turn to what products there were to be transported. The mines and the agriculture of the country are the sources destined to supply the elements of progress to commerce, as well as the advantageous development of the railways; and the Government in its operations has paid the utmost attention to each of these sources of wealth. It is well known that at the time of the discovery of Peru, its minerals pre-eminently excited the attention of its conquerors. Its gold seduced them, and devoting themselves exclusively to its search, Peru became proverbial as the country of gold, as though the other sources of wealth characteristic of its soil had been entirely overlooked. Vessels, laden with the precious metal, sailed for the mother country every two or three years, taking from ten to fifteen millions of hard dollars (from two to three millions sterling), exciting the avarice of the rest of the world. What a small amount was that sum of gold compared with the present product of some of the other branches of commerce in Peru! The precious metals, which at the present time are worked as extensively as they were during the period of Spanish government, occupy the fourth or fifth place amongst the articles of export from Peru. But an immense future is now opened to these precious metals, by the introduction of railways, in reducing very considerably, not only the cost of transport, but also of their production, and this would lead to the re-opening of many of the formerly abandoned mines, which will give the most beneficial results. Already companies were being formed to work mines, which would return incalculable dividends to the capitals invested therein, and it would not simply be the mines of precious metals which give these great results, but all kinds of minerals, stones, and above all the coal which exists, of the very finest quality, in the interior of Peru; and which only await the reduction of the cost of carriage to the coast in order to become of the utmost importance. The Government, with the view of facilitating the formation of these companies, and the investment of those capitals for the general good, had ordered to be sent to Europe a collection of minerals, which would serve as a base for scientific persons to estimate these advantageous speculations. When these collections reached him he would have great pleasure in announcing their arrival to various scientific societies. Agriculture, which might be termed the most solid base of the prosperity of States, occupies in Peru a position second to none, as regards its quality, its variety, and the extent of its products. The immense Cordillera divides the country into three regions, each of which contributes its special products. This renders every cultivation possible in Peru, because there are all kinds of climate, and every variety of soil; but these are not sufficient to obtain an abundant production—hands were also required, and of these they were in great want. The Government of Peru had made the most laudable endeavours to attract immigration; but if the efforts had not yet been successful, a better result might now be expected, with the increased facilities of communication, and with the more extensive knowledge which one country consequently obtains of another, and with the results of past experience. For this purpose, the last Congress of Peru voted a specified sum towards promoting European emigration, and the Government had taken adequate measures to encourage that which would be most specially advantageous to the country, namely, agricultural immigration.

The commerce of Peru had progressed in proportion to the increase of its products and the facilities of transport. Speaking only of its connection with England, the commercial relations between the two countries had doubled in the last thirty years; and if Peru already occupies a distinguished position amongst the nations trading with the United Kingdom, we might well hope a few years would place her amongst the most prominent. This progress was due in a great measure to the wonderful advancement of maritime and telegraphic communications. Thirty years ago, two steamers of 800 tons made monthly voyages along the Pacific coast, whereas now there is a fleet of over seventy steamers, some of which are 3000 or 4000 tons, making daily voyages on the coast, and bringing all those ports into constant communication with each other. The communications by the Isthmus of Panama being insufficient, other lines of steamers have been established, via the Magellan Straits, which more directly connect the coast of the Pacific with the rest of the world. Telegraphs had made progress corresponding to navigation and railways. The telegraphic cable now extends from Europe to Panama, and the Peruvian Government had lent its protection and every possible facility for the laying of a cable between Panama and the coast of Peru, which is to be completed within two years, and connected with the telegraphic communication already existing in the interior of Peru. While speaking of this progress, there was no motive for the existence of any individual or personal vanity, or for any Government or any one generation taking credit more than another. Each one fulfils the destiny allotted to it, and whilst we take advantage of the works of those who preceded us, and of the assistance, the instruction, and the resources of other countries, we should commence by acknowledging the benefits received, appreciate them at their full value, and solicit their continuance. The interest which had been shown by this Society in all that had been said about the state of Peru, appeared to him to show how great a part of her advancement was due to England, and whilst making this sincere acknowledgment, he trusted that the members of the Royal Geographical Society, who contribute so largely to the pacific relations of all the world, would receive this expression of his country's gratitude.

Mr. KEITH observed that the wealth of Peru really consisted not of its guano, but of its agricultural riches and of its minerals, which were to be found on the eastern slopes of the Andes. In crossing the Cordilleras he had seen ample proof of this, and he considered that the money Peru was now spending in developing her mines and extending her railways was much better used than in revolutions and bloodshed. He had entire confidence in the ability of the country to carry out all the undertakings which had been projected. The simple fact that Don Manuel Pardo, an able financier and friend of science, was now President of Peru, was the best guarantee of the future prosperity of the republic.

Colonel CHURCH said he had visited all the district which had been described in the papers, and had travelled over nearly all the Peruvian railways, and could bear his testimony to the stupendous nature of the engineering works that had been undertaken in that country. The fact that two of the lines already reached an elevation almost as high as the summit of Mont Blanc was something to excite astonishment. The railroad of which the United States was so proud—the Union Pacific—attained only a little over half that elevation. Lake Titicaca, the borders of which might now be reached by railway, is 12,505 feet above the level of the sea; while the summit-level of the road is 14,600 feet. Beyond that, however, on the eastern slope of the Andes, were the real riches of the nation; and he had no hesitation in saying, that, when the railways of Peru reached the summit of the Andes, the development of the country would really begin, for the coast would then be in connection with the head waters of the Amazon, and in the valleys

drained by these there were greater riches than were ever dreamed of. That region was entirely unexplored, but Peru was making noble efforts to demonstrate to the world the navigability of her rivers and the wealth of her mines. The Amazon Valley had attracted great attention recently in the United States. Last November he had an interview with the President and the entire Cabinet, and explained to them the efforts which were being made to construct a railway, 153 miles long, around the cataracts of the Madeira. The President promised to call the attention of Congress to the subject, and this promise he fulfilled. He requested an appropriation, for the purpose of making an exploration of the Amazon as far as the mouth of the River Madeira, and of the Madeira as far as San Antonio, a point 1500 miles from the ocean and the northern terminus of the projected railway. An auxiliary expedition was intended to cross the Andes by the Arequipa Railway, and explore all that vast river-system which concentrates at the head of the falls of the Madeira. Application had been made to the Governments of Bolivia and Brazil for permission to send the expeditions, and no doubt Congress would make the necessary appropriation. The Madeira and Mamoré Railway, with which he was connected, would, when completed, open up 400,000 square miles of territory as rich, healthy, and capable of development, as any other part of the world of equal size.

Sir HARRY VERNEY had no doubt that the statements which had been made with regard to the wealth of the eastern slopes of the Andes were perfectly correct. An honoured friend of his, General Miller, formerly Intendente of Cuzco, had often spoken to him of developing the mining and agricultural resources of the neighbourhood of Lake Titicaca, and he rejoiced that their brethren of the United States were engaged in the work. He had seen the mining operations carried on in the neighbourhood of Coquimbo, and he felt convinced that, if the European method of mining could be introduced into South America, an ample return would be made. The only mode of getting the water from the deep mines of Coquimbo was to employ naked Indians to bring up the water in skins, climbing up fissures through the rock without any aid of ladders or other appliances. The part of the Andes which he had crossed was to the south of Lake Titicaca, and was a great deal higher than that referred to by Mr. Markham. He crossed it in winter, and the snow, blocking up the valley under the highest part of the Cordillera, was then 600 feet deep. The Spaniards and Portuguese had engaged in hostilities around the head waters of the Amazon and Paraguay rivers, and where war could be carried on there the arts of peace might flourish.

Mr. C. R. MARKHAM said that the cause of geography was greatly indebted to the President of Peru, Don Manuel Pardo, for the energy with which he had urged on the construction of the railways in spite of such stupendous difficulties. Don Manuel Pardo was not only a politician and an administrator, but he was also a good and sound geographer, and had written a memoir on the province of Jauja, which, for research, for the accuracy of the topographical detail, and for the interest of the speculations which it contained, had seldom been equalled anywhere; the Fellows of the Society would therefore feel extremely gratified to know that the Council proposed to elect the President of Peru as an honorary corresponding member.

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Ninth Meeting, 23rd March, 1874.

THE RIGHT HON. SIR H. BARTLE E. FRERE, K.C.B., K.C.S.I., ETC.,  
PRESIDENT, in the Chair.

ELECTIONS.—*Colborne Baber, Esq. ; Robert Bourne, Esq., J.P. ; Wentworth William Buller, Esq. ; John William Hadow, Esq. ; Captain K. G. Henderson ; Abraham Park, Esq. ; William Payne, Esq. ; Hon. Arthur Louther Pelham ; Captain Montague Protheroe ; Rev. Edward Sanderson ; Edmund Walburn, Esq. ; Francis Gledstanes Waugh, Esq. ; E. Vesey Westmacott, B.A.*

PRESENTATIONS.—*Charles G. Barclay, Esq. ; A. D. Anderson, Esq. ; G. M. Stewart, Esq. ; J. B. Brown, Esq.*

ACCESSIONS TO THE LIBRARY FROM MARCH 9TH TO MARCH 23RD, 1874.—‘The Birds of Berkshire and Buckinghamshire.’ By A. W. M. C. Kennedy. 1868. Donor the author. ‘The Wildbad Spa.’ By C. Burckhardt. Stuttgart, 1863. Donor S. M. Drach, Esq. ‘The Heart of Africa.’ By G. Schweinfurth. 1873. By purchase. ‘Life, Wanderings, and Labours in Eastern Africa.’ By Rev. C. New. 1873. Donor the author. ‘Letter on the Yellow Stone River.’ By the Chief Engineer to Congress. Donor Ed. Jarvis, Esq. ‘Observations on divers Passages of Scripture.’ By Sir J. Chardin. 1764. Donor S. M. Drach, Esq. ‘Geography of England, 1744.’ Donor S. M. Drach, Esq. ‘The Small British Atlas, 1753.’ Donor S. M. Drach, Esq. Two parcels of Stereoscopic Views in Canada, California, &c. (162 in number). Donor C. H. Wallroth, Esq.

ACCESSIONS TO THE MAP ROOM SINCE THE LAST MEETING OF MARCH 9TH, 1874.—United States : Map of Montana and Wyoming Territories. By V. F. Hayden, Esq. (2 copies.) Presented by Dr. E. Jarvis. Rough Sketch-Map of the Bonny River (W. Africa), showing the Oil Markets, &c. By D. Hopkins, Esq., F.R.G.S. Presented by James Irvine, Esq. 2 Admiralty Charts, viz.:—No. 129, Hönö to the Paternosters, Sweden. No. 707, Bavatoubé Bay, Madagascar. Through the Hydrographer, Captain F. O. Evans, c.b. 162 Stereoscopic Views in North America, viz.:—14 Yosemite Valley, 12 Mammoth Trees, California. 46 Central Pacific Railway R. 16 Union Pacific Railway R. 74 Various parts of Canada. Presented by C. H. Wallroth, Esq., F.R.G.S.

#### DEATH OF DR. LIVINGSTONE.

The PRESIDENT announced that letters had been received from Zanzibar announcing the arrival there of one of Dr. Livingstone’s servants, Chumah ; Lieutenant Murphy, with the remains of the great traveller, being within a

few days' march of the coast, which he was expected to reach about the 14th February. It appeared that after the lamented death of Dr. Dillon, Lieutenant Cameron, who had come for a march or two towards the coast to confer with Lieutenant Murphy, had returned to Unyanyembe, and thence gone on to Ujiji to recover the boxes of letters which Livingstone had left there. Mr. Stanley had lately arrived in this country from the West Coast of Africa, where he had been on duty connected with his profession, and he had stated that possibly as many as twelve of the Nassik boys might be still among the party which was bringing down Livingstone's remains, and from some of them, no doubt, full particulars would be obtained of his last days and journeyings.

The Rev. H. WALLER said he had had the pleasure of knowing two of the men who were with Livingstone in his last days; and one of them, Chumah, he had aided the Doctor in liberating from a slaving party on the Shiré many years ago. Chumah was at the head of the caravan which was bringing Livingstone's body to the coast, and it was a mere accident that Lieutenant Cameron and those who were with him were at Unyanyembe when Chumah arrived so far on his journey. No doubt Lieutenant Cameron and his comrades did all that men could do for the exhausted natives, who had brought their precious burden some thousand miles. The task that these men had performed was truly Herculean. They had gone against the prejudices, the fears, the superstitions of the natives, and had travelled a thousand miles before they heard that Englishmen were in their neighbourhood. Chumah and Susi had been with Livingstone for eight or nine years. It was true that they laboured under the great and terrible disadvantage of being black, but still they ought to have accorded to them all the honour which was their due. They merited the greatest consideration. Already inuendos had been thrown out against Chumah; but he had known him as a boy, and had continually heard about him from the Doctor, who always spoke of him with esteem. He (Mr. Waller) begged the Fellows of the Society to suspend their judgment until Chumah arrived in England, to vouch for his integrity in all that he had done.

The PRESIDENT said Mr. Waller must have rather imperfectly apprehended the feeling of the meeting if he supposed that there was the slightest intention to derogate from the honour due to Chumah, but praise could not be justly apportioned until the mournful cortège arrived in England. One of those, who might have been supposed to have been the most prominent and trusted servant of Dr. Livingstone, was not mentioned among the party who were accompanying the body to the coast, and there was some room to fear that he might be among those who had fallen in the great traveller's service; but at the present moment brief telegraphic communications were all that had been received. One thing, however, was certain, namely, that when Livingstone's faithful servants arrived in this country, the Royal Geographical Society would mete out the fair share of praise to every member of the expedition, without distinction of race or colour.

#### PROGRESS OF MR. FORSYTH'S MISSION TO EASTERN TURKISTAN.

The following letters from Mr. T. D. Forsyth to Sir Robert Montgomery were then read by Mr. Markham:—

“Yarkund, November 23, 1873.

“MY DEAR SIR ROBERT,—I send you a letter from Shahidulla, giving an account of our journey to the confines of Yarkund territory, and now I am glad to be able to write from the city, where we are resting before proceeding to meet the Atalik at Kashgar. From the moment we became his guests we have had nothing but the utmost attention and unbounded hospitality,

and I have good reason for saying that our advent has been eagerly looked for, and our welcome now is most hearty. The most complete freedom of action is accorded to us, and, instead of throwing difficulties in our way, all the officials seem anxious to help us to do whatever we wish. This affords a striking contrast to former visits. As we ride through the villages, or wander about the bazaars of this city, the people treat us with good-natured civility. Even the ladies seem reluctant to obey the Oriental custom and universal order for pulling down their veils, and it is only the ugly ones who make a clean bolt of it when they see us coming. They are not above coming to the doctor for medicine.

" We can make purchases freely in the shops, and the traders are beginning to have some sort of conscience in their prices. At first they thought they would reap a rapid harvest, and asked about five times the proper price. But there are one or two Scotchmen among us who know how to bargain, and now we only pay about cent. per cent. for articles.

" I have been greatly struck with the comfort of the people and the neat appearance of the bazaars. The chief ones are covered over, as in Cairo or Stamboul, and there is a good display of wares of all kinds. The poor people are well, that is to say, warmly, clad in strong thick chogas and good leather boots and fur caps. These articles are sold in what is called the Sham, or Evening Bazaar, a large space in which booths and stalls are daily filled by the suburban residents, who bring in their articles for sale. There is a weekly market, when the streets are thronged. The arrangements are excellent. In one quarter is the horse fair, in another the sheep market; a separate one for cows. Then there is the grain market, the poultry market, cotton market. We went to all these, and found the horse-dealers of Yarkund to be just as sharp practitioners as their brethren over the rest of the world. The sheep are remarkably fine, and the mutton excellent. Cows here have no hump, and look as if they had strayed from some English pasture-ground. As you go along the streets you see confectioners, or piemen, wheeling their trays, ready to sell you a copper's worth of toffee, or a clean, well cooked, three-cornered meat-pie. The restaurants are *par excellence* the cleanest and most tempting eating-houses I have seen anywhere out of England. In the vestibule is a large counter, under which is a fire, with a neatly painted chimney to carry off the smoke. On one side of this counter is a large caldron full of mutton broth; next to it is a layer of three large *grèves*, each one containing some delicacy, such as pies, or stews, or vegetables, which are being cooked by the steam which passes through them from a caldron underneath. Then on another part of the counter are big loaves, or rather cakes of bread, made of white flour, and several dishes of food and vegetables done up in a tasty form to tempt the passers by. Inside are tables and forms for the most fastidious folk, and outside are the little boys ready to pop their fingers into the sweets or soup, or whatever they can find: thus showing that human nature is the same here as elsewhere.

" There is plenty of game of all kinds all round; and within half-a-mile of the city we have got snipe, duck, and geese. Pheasants are to be had in the jungles around; deer, hares too, and some of our party went out for two days' sport after them. I think I have said enough to let you know that we have taken the Atalik at his word, and made ourselves perfectly at home, as he wrote and begged we would do. I only wish we could find a little *warmer* welcome from the climate, for the thermometer has a most unpleasant tendency to get below zero, and when we make any remark we are told that winter has not begun yet, but when it does set in then it will be really cold. Shopkeepers, too, offer us all sorts of curious garments, and tell us that we shall want them, and a good deal more besides, ere long. I daresay you will have heard of our adventures crossing the last pass into Yarkund, and our

difficulties owing to the ice. I never had such work in my life, and feared all my mules would be killed by their constant falls down the icy slopes. I consider I was very fortunate to lose only eight mules and three or four ponies.

"Syad Yakoob Khan is a most remarkable man, and a true friend and counsellor to me. I place myself entirely in his hands, and every day have reason to rejoice having done so. Having been twice to Constantinople, and being a man of great intelligence, he thoroughly understands European politics and customs; and, being wonderfully free from prejudices, he can enter into our society and appreciate our ways.

"At the outset I adopted as our rule the maxim that honesty is the best policy. I have told him everything about every theodolite and every pundit, and make no secret or mystery of anything, but always ask his advice before action. Sometimes he advises caution, but quite enters into a joke. For instance we have in our photographic department a little apparatus for taking pictures quickly without the usual bother of fixing and focussing, &c. When we reached Yarkund he said the Dadkhwah was a bigot, and an ignorant man as regards Western civilisation; so he advised us to keep photography in the background, but wanted me to take the Dadkhwah's likeness unknown to him. However, discretion is better than joking, so I have not yet got a likeness of the Dadkhwah.

"The Syad has just gone off to Kashgar, leaving us to follow next week, and we are now busy getting carts, camels, and ponies, from the Dadkhwah for our march. The double-humped camels are remarkably handsome. The carts are drawn by horses, one in the shafts, and generally three abreast in front. I shall not venture on political news till I can write after seeing the Atalik, or Ameer as he is now to be styled. But with regard to the story of the Chinese having driven back his forces, I have conversed with several officers who have come from Oorumtsi, and they tell me that his army has taken Manas and 7 or 8 other towns. Between Manas and Kuldja are 16 posting stages, of which 10 belong to him and 6 to Russia.

"I ought to have told you about the Syad bringing 2 mountain guns and all the equipment, and 7 or 8 Turkish officers over the Karakorum with him, but have not space left. A few years ago I was disbelieved when I declared these mountains to be *not* impassable.

"Yours very sincerely,  
"T. D. FORSYTH.

"You shall hear from Kashgar. Meanwhile let me wish you all the compliments of the new year coming on.

"There are abundant supplies of Russian goods in the Yarkand bazaars, but no Russian merchants. On examining the goods we found, in many instances, the names of English manufacturers, so that our trade is coming in on both sides, and we need not complain of Russian commerce advancing."

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"Kashgar, December 11, 1873.

"MY DEAR SIR ROBERT,—I am glad to be able to tell of our arrival at the Atalik's capital, and of our hearty welcome by His Highness. We left Yarkund on the 28th November, and found houses, or quarters, comfortably fitted up for us at each stage. About 8 miles from Yarkund we were invited to dismount and have a sumptuous breakfast in a house; and, as we had had a cold ride, it was very agreeable to find a well carpeted room with a bright fire, and good hot food. We again mounted, and at once found ourselves crossing a bleak desert, till we reached the village of Kok Robat, where we were lodged for the night in an "oorda," or Royal Resting-place. Next

morning our route lay, as before, across a desert, and the cold was something indescribably intense. With furs and wraps we could not keep out the cold, and it was a great relief to dismount at noon at a small eating-house and thaw ourselves before a fire. Here we were met by the Military Governor of Yungi Hissar, who came out with 20 horsemen to escort us to Kashgar. Khal Mahomed, the Governor, holds the rank of Panjendbashee, or Commander of 500. He is a young man, and a special favourite of the Atalik. He has a dashing appearance, and brought his men—all most neatly dressed—up to meet us in capital style, wheeling them round with a precision which was much commended by my military companions. As soon as we reached this inn the Panjendbashee and his men dismounted, and immediately afterwards appeared bringing in dishes of hot meats, sweets, &c., Khal Mahomed himself waiting on us. After a good warm, inside and out, we remounted, and rode to Kizil, a large village, where we saw iron furnaces, but not now at work, it being winter-time. Next day we rode into Yungi Hissar, and evidently afforded much amusement to the inhabitants, who turned out in crowds to see the Feringhees. Yungi Hissar is a large town, with a fine bazaar down the main street. There are numerous walled enclosures with crenellated tops, giving the appearance of forts. Inside one of these is the Chinese quarter, where about 1000 Chinese live, who escaped the sword by turning Mahomedans. Outside the town, on a broad plain, is a very respectable fort, with towers, ditch, drawbridge, everything about it betokening due military care. We were taken to a garden, some little distance off, inside which we found a courtyard with a good gateway to it, and inside suites of rooms, and Kirghiz felt tents pitched, with large fires inside. Next morning we rode in here, being met about three miles from our residence by Mirza Ahmad Kooshken, one of the highest officers in the Atalik's Court, and formerly Governor of Tashkund, till ousted by the Russians. The British Embassy in Kashgar is, I assure you, a remarkably comfortable place. There is a spacious gateway, with raised dais (and fireplace), for our guard to sit or lie down on. Thence you pass into a spacious quadrangle with a broad flat verandah all round, and on two sides are good large rooms for the native part of our body. Passing through another gateway and passage you come to a large quadrangle, on three sides of which are rooms for us. These are small, but most comfortable, especially for winter-time. I have a sitting room and bedroom, with a little verandah connecting the two. The room is neatly built, and the window has double frames, the outer one having white paper instead of glass, and inside are wooden shutter-doors. Good Khoten (like Turkey) carpets on the floor. The sides of the room for three feet from the ground are hung with velvet, and above the walls are divided off into recesses, forming convenient shelves for books. Good fireplaces and a cheerful wood fire make the room as snug as possible. All the rooms of the officers are the same, except the velvet; and, perhaps, the papering of my ceiling is more gorgeous than that of the others. Beyond this quadrangle is a courtyard, where Dr. Bellew has started a dispensary. There is a separate court for our baggage animals, and good warm stables, with stalls, for 50 horses. We have a good-sized mess room, with the kitchen close by at the back. All this has been built for us, and, unfortunately, some of the building is not yet quite dry. But the taste and care with which everything has been arranged are quite marvellous. Little matters which tend greatly to one's comfort, yet which might easily have been forgotten, have been carefully attended to, and any alterations we wish to make are at once carried out. This embassy is situated about 50 paces outside the gate of Yungi Shah, the King's Fort, and is about 5 miles distant from the City of Kashgar. Neither Shaw nor Hayward ever reached this city, being left inside the Fort of Yungi Shah.

"As soon as we arrived a messenger came from the Atalik requesting us to

go, as we were to present ourselves in a friendly manner before him, leaving the ceremonious reception for another day. So we tumbled into uniform as fast as possible, and, mounting once more, rode into the Fort. We found soldiers ranged outside the gate of the palace, where we dismounted, and, passing through two large quadrangles filled with soldiers, who were seated all round the four sides in perfect silence and motionless, we entered the third court, which was quite deserted. At the end was a long hall, the private-apartment of the Atalik. I was taken in alone, and found the Atalik standing unattended. He received me very cordially and seated me by his side, asked after the Queen's health, the Viceroy's, hoped we had been properly treated by his servants on the road, &c. Then he called in the other officers one by one, shook them by the hand, and made them sit down. There was a little conversation, but chiefly he sat silent eyeing in all most keenly. Tea and fruit, &c., were brought in, and then we rose to depart, he wishing us-welcome in a very hearty manner. The Atalik is a thick set man, about 5 feet 10 inches, with a broad good-humoured face. He has now formally assumed the title of *Ameer*, and is *Ameer Yakoob Khan*, instead of Yakoob-Beg as heretofore, so that the title of Atalik Ghazee may be dropped by us. As I was taking my seat by his side a salute of 15 guns was fired in honour of the British Envoy. This is quite an innovation, and is the first salute that has been fired for anyone but the Ruler himself, so that the Ameer has done due honour to our Government. To-day I presented the letters from Her Majesty and the Viceroy with all due ceremony, and the Ameer expressed the utmost gratitude for the kindness and favour shown him.

"But I will not inflict a crossed letter on you. So, wishing you and Lady Montgomery all the compliments of the season,

"Believe me, yours very sincerely,

"T. D. FORSYTH."

The paper of the evening was as follows:—

*Notes of a Journey in the Island of Yezo in 1873, and on Progress of Geography in Japan.* By R. G. WATSON, late *Chargé d'Affaires* in Japan.

In the course of last summer I had an opportunity of passing six weeks in the island of Yezo, the most northerly of the three chief islands of Japan, and of making a journey of about 300 miles in the interior. As the route I passed over is included in that of Captain Blakiston, a detailed description of which was read before this Society in 1872, I should not have thought of inviting your attention so soon again to Yezo, but for the marked changes which have occurred in that island, and the discoveries which have been made there since the date of Captain Blakiston's journey. To an account of these changes and discoveries I shall mainly confine my remarks. Yezo, though one of the three main islands of Japan, is placed on a different footing from that of all the other portions of the Mikado's dominions which lie to the south of it. It is considered rather to be a colonial possession, and its entire administration is placed in the hands of a distinct office, called the Yezo Colonization Depart-

ment, which has its head-quarters at Tokei or Yedo, and the Chief of which is likewise the Governor-General of Yezo. Although the island of Yezo may perhaps be somewhat larger than Ireland, the number of its inhabitants, as estimated by the Japanese authorities, does not exceed 124,000, of which number about 16,000 is assigned to the Ainos or aboriginal population of Yezo and the islands adjoining it to the north. Of these islands, that of Saghalien has of late years been to some degree colonised by Russia, as being to a great extent uninhabited land, although a portion of that island has been always claimed by Japan and is still occupied by Japanese. It was probably the colonisation of a part of Saghalien by a foreign Power, and the fear of the plea of non-occupation being likewise set up in favour of the occupation of a portion of Yezo, which induced the Japanese Government some three years ago to concert an extensive scheme, with the object of opening up this island and colonising it from the central and southern districts of Japan. Accordingly the Japanese representative in the United States was instructed to enter into engagements with a number of American scientific officers, who arrived in Japan two years ago and were placed at the disposal of the Yezo Colonisation Department. The chief of this mission, General Capron, at once set about the task of developing the resources of that island. He established at Yedo three model farms, and took measures for obtaining stock, seeds, grasses and plants from America, with the object of their being introduced into the northern island of Japan.

In the spring of 1872 he and the gentlemen with him proceeded to Hakodate and began to explore the island which was to be the scene of their operations. Previously to their arrival the Japanese authorities had established the future seat of government of Yezo at a locality called Saporō, distant about 140 miles from Hakodate, and about 20 from Utarunai, the nearest port on the Western coast. At this spot a town, covering about a mile square, has sprung up within the last three years, and an excellent road has been constructed by American engineers connecting it with either coast.

The first section of this road extends from Hakodate to Mori, on Volcano Ray, and is 30 miles in length. There then occurs a break in the continuity of the road, and at Mori one has the choice of going round the bay to Endermo, some 60 miles, by the old Japanese mountain-path, or of crossing the bay in a junk or open boat, or by the steamer which plies twice a month either way across. Of the country between Hakodate and Mori I need not give a detailed description, as I find it has already been described in the 'Journal' of this Society by Captain Forbes, R.N. I would only remark that the

cuttings which have been necessitated for the construction of the new road have afforded much insight into the geological formation of the region. The country for many miles is overlaid with several ranges of pumice which has been from time to time thrown out by the overhanging volcano of Homogataki. The relative depth of the layers of pumice affords the means of arriving approximately at the respective dates of the successive eruptions of the volcano. At some points of the cutting there are from five to six inches of mould above the latest stratum of pumice, below which again there are some 18 inches of mould, and then another substratum of pumice.

The last eruption of the volcano is said to have occurred eighteen years since, and therefore it may be inferred, assuming the correctness of this date, that there was a previous eruption about sixty years before. From this it will be perceived that Yezo enjoys no exemption from the volcanic influences which make themselves so often and so markedly felt in other regions of Japan.

Opposite to the village of Mori, on the further side of Volcano Bay (which is about 20 miles in breadth), is situated the admirable harbour of Edomo, or Endermo, or Moraran, one of the finest natural harbours which could be anywhere met with. From the entrance to the innermost point is a distance of about 7 miles, and in the middle of the entrance is a small island, which, were it fortified, would completely command the approach to the harbour. As Endermo possesses such manifest natural advantages, and is, moreover, situated on the mainland of Yezo (Hakodate being on a tongue), it seems somewhat singular that the Japanese Government, in framing their scheme for opening up the island, should have overlooked the facilities which would be afforded towards the realisation of that scheme, by transferring to Endermo the seat of the local government, which is now at Hakodate, and by opening the former port to foreign commerce. Endermo is equally accessible with Hakodate from Yedo and Yokohama, and were shipping to go there direct a manifest economy would be effected to persons engaged in trading transactions, in the saving of the 30 miles of land passage from Hakodate to Mori, and in avoiding the conveyance of goods across Volcano Bay. These considerations are so manifest that, should Yezo ever become settled to any considerable extent, Endermo must of necessity supersede Hakodate. At Endermo the road to Saporō recommences, and continues to that place, first along the coast for 45 miles, and then in an almost direct line through the forest which covers the hills for a similar distance. The entire distance lies through a region clothed with the richest vegetation, the neighbouring hills being covered with

splendid forests containing trees of the most serviceable varieties—the oak, maple, walnut, birch, and pine being prominent amongst them, whilst the geniality of the climate is attested by the presence of the magnolia and other trees, natives of southern or tropical countries. This contrast of trees forms, indeed, one of the most marked features in Japanese scenery. Every one who has passed through the inland sea must have been struck by the unusual combination of pines and cedars on the one hand, with palm-trees and bamboos on the other. To the right of the first half of this road from Endermo, and lying between it and the Pacific Ocean, are a number of the Ainos' villages, all more or less counterparts of each other. The houses or huts, which are covered over with straw on the walls as well as on the roofs, are ranged round a square, on one side of which there is a large oil-pressing house, from which the dried fish is taken to be exposed in the adjoining square when the oil has been extracted. The fish (sardines), after having been dried in the sun, is exported to serve as manure. An Aino village is almost invariably built on the sea-shore, and in each village there is an elevated look-out post perched on strong poles, from which the approach of a shoal of fish may be discerned. There is also another lower look-out in the village, from which warning may be given of the approach of bears. Each Aino hut has but one outer door and no windows, but there is a hole in the roof to admit of the escape of smoke. The hut is divided into two compartments, the inner being larger than the outer one, and being piled round with fuel, dried fish, and utensils for cooking, &c. The Ainos' food is fish, roots, and venison. There is in each hut a loom, and on the whole the interior presents more appearance of comfort than one would expect from the rough appearance of the Ainos themselves. The women carry the children strapped on their backs, the front of the strap passing over the mother's forehead. The women wear their hair cut short at the back of the neck, and their upper and lower lips are tattooed and stained in imitation of moustaches. The married women do not adopt the Japanese married women's custom of blackening the teeth. The Ainos have a very peculiar mode of equitation, balancing themselves on the horse's bare back, their legs dangling on a level with his neck. They are well-grown men, with good features, and an immense quantity of coarse black hair covering nearly all parts of the person. The men wear coats of bark. . . .

The origin of the Aino race, which, like other wild races, is said to be fast disappearing, is a disputed question. Japanese records prove them to have at one time inhabited districts as far south-

wards as Yedo, and they are known to have even recently existed in considerable numbers in the province of Sendai; but now they are confined to Yezo, Saghalien, and the Kurile Islands. M. Goskavitch, formerly Russian Consul-General at Hakodate, the Abbé Mermet, and M. Sindau, have devoted much attention to this subject, but the absence of any Aino written language reduces its investigation almost to conjecture. They are a remarkably strong race and are individually very courageous, though collectively in abject terror of the Japanese. Their language is mellifluous, and their manners are gentle towards strangers, abject to Japanese officials. Though formerly oppressed, they have been better treated since the revolution of 1868. They worship the sun and the idea of a Japanese power which means merely force: they likewise adore their ancestors. They have no idea of computation, and refer dates to certain events, such as the catching of a whale or the advent of a great shoal of fish.

The Ainos have not escaped the attention of the Japanese Government in their efforts towards the reconstruction of all things throughout the empire. The scheme as affecting the Ainos is said to provide that they shall be civilised by Japanese wives. There is in the Yezo Colonisation Department a school at which 50 Japanese girls (daughters of officials) are being educated at the public expense by Dutch instructresses. These girls are, I was told at the school, destined to be the wives of Ainos. This is—supposing the scheme to be carried out—as if a number of girls were to be taken from a London ladies' school, and sent to be married to Gaelic-speaking Celts of Connemara. It is to be regretted that up to the present time no foreigner should have undertaken the task of mastering the Ainos' language, but it may be hoped that ere long one or other of our Japanese scholars will turn his attention to a study which could not fail to throw much light on the comparative philology of that region of the world.

The road from Endermo to Saporō leads over several considerable streams, at which one may have excellent fly-fishing, and some idea of the amount of game which sportsmen would find in Yezo may be gathered from the fact that 30,000 pairs of deers' horns are each year exported from Hakodate. From the point at which the road leaves the sea-coast it leads, through continuous vegetation, to Saporō, the traveller at one time passing through miles clothed with lily-of-the-valley, and at another through fields of wild roses in bloom. The town of Saporō, being built entirely of wood, presents a much more finished appearance than a town of such recent date could present under other circumstances. It is

connected by a small canal with the Ishikari River, which is 15 miles distant.

The main industry now apparent in Saporō is the preparation of wood, two steam sawmills being constantly in operation under American superintendence. The forests of Yezo constitute one of the chief sources of the wealth which might be obtained from the island. It is estimated that, by a total outlay on setting up machinery of about 5000*l.*, there might be prepared daily in these forests a quantity of timber worth about 250*l.*, or 78,000*l.* worth in the working year of 312 days, less the cost of working the machinery for ten hours daily, and the above figures might be doubled were the machinery worked by two relays of men in the twenty-four hours. According to the estimates which result from enquiries instituted by General Capron, one average acre of Yezo forest may contain about 42,500 feet of planking. It will thus be seen that a grant, say of 1000 acres, would afford the elements of very considerable profits; and when it is considered that these forests extend over an area perhaps equivalent to nearly that of Ireland, it will be seen what an extensive resource the Japanese Government possess at their command in the forests of Yezo alone. I may add that, whilst this source of wealth continues undeveloped, timber of qualities similar to that found in Yezo is being each year imported into Japan from Oregon and elsewhere in the United States over a distance of between 5000 and 6000 miles. Timber, of qualities which might be procured in Yezo, is likewise being constantly brought from the United States to Hong-kong. The natural development of its forests is perhaps the most obvious, but it is by no means the sole, source of the wealth which might be produced in Yezo. I travelled for some short distance up the Ishikari River, and then proceeded down the river to its mouth, where I had an opportunity of seeing the establishments there, connected with the salmon and other fisheries. Salmon and other fish are caught in the rivers and on the coasts of Yezo in enormous abundance. Salmon is there so cheap as scarcely to have a price, according to our idea of the word; and I was told by an English merchant of Hakodate that, were the fisheries of Yezo open to foreign enterprise, tins of prepared salmon, which would now sell in London for about 9*d.* might be placed in London for 2*½d.* per tin. As it is, the fisheries of Yezo, as at present managed on behalf of the Japanese Government, although they even now supply a great portion of the revenue derived from the island, afford but a very small proportion of the revenue which under better management ought to be extracted from them. The revenue system adopted is that the

Government receive one fish in so many, and, in order to ensure that the Government should receive its due proportion of fish, there is employed at the fisheries a host of Government officials. As one of the American officers expressed it to me, in answer to my inquiries, "Sir, there's an official for every fish caught."

In addition to its forests and fisheries, Yezo possesses a source of future wealth in its mineral productions. I had an opportunity of travelling on the Ishikari River with Mr. Lyman, the geologist of General Capron's Mission, and who was formerly employed by the Government of India in surveying the Punjab in search of petroleum. He informed me that he had found in different parts of Yezo traces of silver and lead, manganese, iron-pyrites, ironsand, copper, zinc, rock-oil, and gypsum, as well as sulphur in abundance. By far the most important mineral production of Yezo, however, consists in its fields of coal. As the mines of Iwanai have been described by Captain Blakiston, I need not go over the same ground. Mr. Lyman, at the time I met him (in July last), seemed to think it probable that these coal-fields might be found to contain, perhaps, 3,000,000 tons in each layer, there being six transverse layers. I was also informed, subsequently to my leaving Yezo, that Mr. Lyman had lately discovered vast fields of coal on or near the Ishikari River. The Yezo coal, though not of the finest description, is perfectly serviceable for steaming purposes, and were these coal-fields thrown open to the general markets of the world, there can be little doubt that, from their accessible situation, their produce would be in great request, and would, whilst affording large returns to Japan, greatly cheapen the price of coal on Eastern seas.

It may naturally be asked why, if such be the resources of Yezo, are they not turned to immediate practical account? I shall endeavour to explain the political conditions which over-rule the commercial interests of the island. Yezo is, in common with the rest of Japan, a closed land to all foreigners beyond what are known as the Treaty Limits, that is to say, beyond a distance of 30 miles from Hakodate, which is the only open port in Yezo, so that, until the restriction on the free admission of foreigners into the interior be removed, foreign independent enterprise and capital must alike be excluded from everywhere but the one open port—a state of things which is the more to be regretted on account of the existing management of the island. It would be easy to cite numerous instances which came under my own observation, as well as many more which were repeated to me, showing how money may be thrown away; but one instance will

serve as a sample of many. The Japanese administrators in Yezo, with other branches of the foreign civilization which they have adopted, have not overlooked the custom of giving out contracts to persons who may have the means of making themselves believed in by men in power. It is on this hypothesis alone that I can explain the existence of four admirable breakwaters which I saw: one at Mori, on Volcano Bay; and three near the mouth of the Ishikari River. The one at Mori, which I paced, is 500 yards in length, and is said to have cost the Government 80,000 dollars, yet at the extreme end of this pier the depth of water is only 7 feet, so that not even a junk, far less a steamer, can, even in the most favourable state of the tide, be brought alongside it to be loaded. For all practical purposes the pier might as well have been constructed in the interior of the country. The three piers on the Ishikari River afford even a more striking example of mismanagement, to say the least. Near the mouth of the river in question there is on one side of the stream a depth of from 70 to 80 feet of water, whilst at the other side the depth for some distance from the shore does not exceed from 7 to 10 feet, yet the piers are on the shallow side of the stream. The restrictive policy of the Japanese Government with regard to foreigners—which is applicable to Yezo as to the rest of Japan—is not now, at any rate, dictated by any antipathy to foreigners, but solely by the reluctance of the Japanese Government to extend beyond its present limits the extra-territorial jurisdiction which treaty powers exercise over their respective subjects or citizens throughout the dominions of the Mikado. The Japanese Government has announced its willingness to admit foreigners freely into all parts of Japan on the sole condition that, whilst beyond the present treaty limits, they are to be subject to Japanese jurisdiction; but this condition the Treaty Powers have not accepted. It may reasonably be hoped, however, that ere long some compromise will be arrived at which, while it will save the susceptibilities of the Japanese Government, will at the same time afford the Treaty Powers a sufficient guarantee for the full protection of the persons and property of their respective subjects throughout the interior of Japan. Whenever the period arrives that shall see Yezo opened to foreign colonisation, I should imagine that its excellent climate and great resources would attract to it a fair share of European immigration. Its climate, though considered by the Japanese to be too rigorous, is admitted by Europeans to be excellent. Throughout the month of June last, and up to the 4th of July, I was glad to sit over a fire even at noon, and to sleep under a thick quilt at night. The Japanese

are so averse to subjecting themselves to what they call the rigour of the Yezo winter, that many thousands of fishermen, labourers, and others, who come to Yezo from other islands for the summer months, quit it for their homes on the approach of winter; but winter, in an island which produces rice, hemp, and maize, would scarcely seem formidable to Europeans.

The entire island of Yezo is now being surveyed under the direction of Mr. Wasson, one of General Capron's officers. I visited his field establishment at Yubutz, and he informed me that he hoped that by the end of the present year, 1874, his operations would be so far advanced as to admit of his laying down accurately the more prominent points of Yezo, and framing for the first time a correct outline map of the island. His labours will, no doubt, in due time be appreciated by this Society.

I returned from Saporö, or rather from the mouth of the Ishikari River, to Hakodate by the western coast, passing several considerable ports, in one of which, Utarunai, I counted 102 junks. The coast for a great distance is faced with abrupt rocky cliffs, and nothing could be more delightful than the scenery. The road above the cliffs winds over undulating grassy ground, the forest being everywhere visible at a short distance in the interior, and the villages are so numerous as to make it difficult to believe that the Japanese authorities do not greatly under-estimate the population of the island. I presume that the explanation of the low figure at which it is stated is, that the inhabitants of these villages quit them for the adjoining island on the approach of winter, and are not included in the census of Yezo.

The coast of the island of Yezo has within the last three years been surveyed by Captain St. John, of Her Majesty's ship *Sylvia*. The western coast of Yezo, and more particularly the neighbourhood of Matsumai, has an interest of its own, as having been the scene of the captivity and wanderings of Captain Golownin, of the Russian navy, whose narrative of his captivity in Japan during the years 1811, 1812, 1813, affords, I think, in a greater degree than almost any other work a comprehensive insight into the manners of the Japanese and into their former governmental system. The work of Captain Golownin is unique of its kind, owing to the very peculiar circumstances under which it was written, in affording information drawn at first hand, and not by hearsay, of Japanese manners and customs. Captain Golownin, whilst on a surveying cruise in the Northern Japanese waters, was treacherously taken prisoner by the Governor of Kunnashier, on account of some depredations which had previously been committed on Japanese soil by another Russian

naval officer. Captain Golownin and the three officers who had been seized along with him were detained for twenty-six months at various places in captivity, and it is most surprising that, under the very strict and constant surveillance to which he was subjected, he should have found the means of registering the notes forming the basis of his highly-interesting narrative. It affords alike an evidence of the amiability inherent in the Japanese character and of the candid disposition of Captain Golownin in that, notwithstanding the treacherous circumstances which attended his capture, he should express himself in terms of so much admiration of the Japanese and of their institutions.

Having now concluded my remarks on the island of Yezo, I would beg to direct your attention for a few minutes to the subject of geographical progress in the empire of Japan in general. The Japanese Government are fully alive to the utility of having the whole of the Mikado's dominions accurately surveyed by duly qualified scientific officers, and for this purpose they last year sent to England their chief surveyor, Mr. Macvean, who was instructed to engage the necessary officers and to procure the necessary instruments. How far Mr. Macvean may have proceeded in his arrangements I have no means of knowing, as he had not returned to Japan at the date of my departure in December last. Previously to his leaving Yedo he had been engaged in preparing a survey of that city, which work, in his absence, is now being carried on by the subordinate English officers of the same department.

I have already mentioned that the coasts of Yezo have been surveyed by Her Majesty's ship *Sylvia*, and I should add that other portions of the Japanese waters, more particularly of the Inland Sea, have likewise been surveyed by British or French surveying vessels. As the Japanese Government have recently engaged the services of Commander Douglas, R.N., with forty-one other officers, petty officers, and seamen of the Royal Navy, as instructors in the Naval College at Yedo, and have established at that place a hydrographical department, it may be hoped that, ere long, the Japanese will be perfectly competent themselves to undertake the survey of such portions of their coasts as may not have already been accurately laid down on charts.

Apart from scientific geographical explorations properly so called, there has of late years been in Japan an immense progress in general acquaintance on the part of foreigners with all regions of the country. Although the rule as originally framed is still in operation, by which no foreigners, with the exception of ministers and their suites, are

permitted to travel in any part of Japan outside of the Treaty limits, yet, owing to a variety of circumstances, foreigners of one or other nationality have in fact visited nearly every province of the Mikado's dominions.

Her Majesty's first minister in Japan, Sir Rutherford Alcock, whose valuable notes of travel throughout a very large portion of the country are included in the 'Journals' of this Society, was the pioneer amongst modern explorers of that empire. Her Majesty's present minister, Sir Harry Parkes, has likewise travelled across the country, and visited all the most important localities in it. The late minister of the United States, Mr. De Long, travelled from a point on the main island opposite to Hakodate, overland to Yedo, a distance of some 500 miles.

In August 1867, Messrs. Mitford and Satow travelled across country from Nanao, a harbour of the Prince of Kaga, on the western coast, to Osaka, on the eastern. They passed through the rich provinces of Kaga, Echizen—famous for silk and cutlery, the province of Ii Kamon no Kami, and the country about Kioto. This journey was performed without any escort, these gentlemen throwing themselves on the hospitality of the Daimios through whose dominions they passed, written receipts for their persons being required and delivered at each frontier post.

Probably no one has travelled more in the interior of Japan than Dr. Willis, formerly physician to her Majesty's Legation, and whose journeys have always been undertaken from motives of charity. In the years 1868-69, he made a journey under peculiarly difficult circumstances, in the depth of winter, in order to attend the wounded troops at Wakamatsu, the capital of the rebel Prince of Aidzu, in the north of the main island, which was then being besieged by the imperial troops. Amongst other foremost Japanese travellers should be named Mr. Aston and Mr. Wirgman.

The journeys of Mr. Adams are included in the records of this Society, and two gentlemen of her Majesty's Legation, Messrs. Lawrence and Satow, have been the first Europeans to travel over and describe the mountain-road (the *Nakasendo*) between Yedo and Kioto, the southern capital; the *Tokaido*, or sea-coast road between the two capitals, having been previously explored. Mr. Lawrence's description of the Nakasendo route is likewise in the possession of this Society.

The most famous mountains of the country have been, one after the other, ascended by our countrymen: the peak, second in fame to Fuzi Yama alone having been last year climbed and measured by Mr. Lawrence. The results of many of these expeditions are

now chronicled in the 'Journal of the Asiatic Society of Japan,' which Society was founded about twenty months ago, and their comparison will no doubt in due time lead to the furtherance of the knowledge of the geography of the country. The Japanese Government have in their employment a very considerable number of foreigners, and an exception is made in the case of these gentlemen to the rule which prohibits foreigners in general from travelling in the interior of the country. The result is, that a large amount of scientific and general information has been acquired through them respecting the interior of Japan. A survey, for instance, has been made of the line of country lying between Osaka and Kioto, and of that between Lake Bewa and Tsuruga, on the western coast, and likewise an inspection by Mr. Boyle, c.s.i., the chief engineer, of the route from Kioto to Yedo; all of these being with a view to the construction of railways between these places, respectively. From what I have said, I think it may be inferred, that even should the present policy of confining foreigners in general within the Treaty limits be persisted in, there are fair grounds for hoping that ere long the scientific world will be in possession of the fullest geographical information of the Islands of Japan—an empire which so recent a writer as Dean Swift coupled with the visionary regions of Lilliput and Brobdingnag. There can be no doubt, however, that geographical discovery in Japan would be greatly accelerated were the country freely thrown open to foreign travellers, and the date at which it will be so is, I think I may say, merely a question of a few months more or less.

Meanwhile, such foreigners as may have the privilege of travelling in any part of the interior of the country meet with the utmost possible cordiality and good-will. All obstruction in the way of the circulation of foreigners throughout the country proceeds from the Government, and by no means from the Japanese people. The state of things which I describe with reference to the mutual relations between Japanese and foreigners, is so opposite to that which notoriously existed between them but a very few years ago, that persons whose experience of Japan may not be of so recent a date as my own, may have some difficulty in realising that my description is not over-coloured.

Facts, however, speak for themselves, and from one or two which I may mention, I think you will draw but one conclusion. When I arrived at Yedo, in May 1872, I found at Her Majesty's Legation a Japanese mounted escort for our protection, of forty-three men; and wherever any of us went, on foot or on horseback, in the city of Yedo, or within a distance of many miles around it, we could never,

unless when in-doors, escape the surveillance of these guards, whose lives, had anything happened to us, would have been forfeit for ours.

Being convinced that the anti-foreign feeling which had called for such measures of precaution in the case of members of a foreign Legation had almost entirely passed away, I readily met the Japanese Government in a proposal that these guards should be withdrawn; and within two months of my arrival at Yedo they were so. From that time onwards I was in the habit of going about Yedo in all directions, at any hour from dawn till midnight, having no person whatsoever with me, excepting a groom to hold my horse or to carry a lantern, if at night. I slept, in summer, in a room with windows and doors open. I never carried a stick or whip for defence, and never once had my revolver loaded.

I have visited all of the seven Treaty ports, viz.: Yedo, Yokohama, Hiogo, Osaka, Nagasaki, Niigata, and Hakodate; and have further visited the southern capital, Kioto, and likewise made a journey to the Tombs of the Tycoons at Nikko, in addition to excursions in the neighbourhood of Yedo, and I may say that in no country in the world in which I have travelled—in Asia, Europe, or America—have I, wherever I went, been received with such unmistakable and invariable welcome; whilst I never, under any circumstances, was subjected to a single unpleasant look or word.

Nor is this experience my own alone. I had ample opportunities whilst in Japan of conversing with, or hearing from, or of, such foreigners as were permitted to travel in the interior of the country; and so far as I know, the experience of one and all, during the last two years, entirely coincided with my own. Nor, I apprehend, is it in the least degree probable that the present existing feeling of cordiality towards foreigners is of a transient or ephemeral character. Such a supposition may be at once rebutted by a reference to the statistical fact that there are now under instruction some 430,000 Japanese on the Western system of education, whilst the number of youths who are receiving instruction on the formerly adopted Chinese system number only some 300 in the entire city of Yedo.

The rising generation are being taught to sit on chairs, to write at benches, thoroughly to understand English, and to master the various branches of Western education.

Such being the case, it may, I think, fairly be assumed that the interior of Japan will not long remain a region into which foreigners are forbidden to enter. Many persons seem to consider that the progress of new ideas and the adoption of Western customs amongst the Japanese has been so unprecedentedly rapid, that it therefore

cannot be lasting; but, whilst it must be admitted that the history of the world furnishes no parallel to the recent civil revolution in Japan, it should, I think, be at the same time allowed that it would be contrary to the lessons of history to expect that an empire, which has adopted such institutions as those which Japan now possesses under a central government, should revert to the feudal system.

For my own part, in so far as I may be capable of forming an opinion, I entertain no apprehension whatsoever regarding the stability of the present order of things in Japan. However rapid may have been the progress onwards, that progress has been continuous. Although the manners and customs, the laws and institutions, of an ancient people may not be changed in a year, or in a decade, there has still, since the adoption of Western civilisation was decided on, been a continuous advance towards the goal in view; and popular sentiment seems to go hand-in-hand with the progressive statesmen of the country,—with one instance of which feeling I may bring this paper to a conclusion. As is well known, it has during many centuries been the custom that Japanese nobles and gentlemen should, whilst beyond the precincts of their houses, carry on their persons the two swords which were the badges of their rank. This custom, indeed, on the part of these privileged classes, had become so ingrained in the ideas of the entire inhabitants, that the Government, at a very recent period, expressed themselves as believing, that were any order to be issued which should prohibit the carrying of swords, such an order might cause a revolution. Accordingly no order on the subject was issued, but the compromise was subsequently tried of issuing a Government notification to the effect that for the future the nobles and the *Samurai* need not, unless by their own preference, continue to wear their swords.

The result was that in an almost inconceivably short space of time the usage of wearing swords was abandoned, and it is now almost as unusual to meet in Yedo a Japanese wearing the old two swords, as it is to meet a gentleman in London attired in the Highland costume. Indeed, last year when the senior Prince of Satsuma, who is at the head of the small anti-foreign party in Japan, visited Yedo, with a large retinue of followers, their now almost obsolete custom of carrying swords afforded so constant a source of ridicule, as these Satsuma men passed through the streets, that they soon found it convenient to keep within doors. Their Prince, though still preserving his antipathy to the intruders from the West, has established, at Kagoshima, a medical school for the instruction of Japanese youths by two foreign doctors, engaged by the Prince of Satsuma: thus showing that even the head of the anti-foreign party himself

recognises the fact that, however unwelcome to the ex-Daimos, of which he is the representative, the new order of things in Japan must be accepted as being inevitable.

The PRESIDENT, after returning the thanks of the Meeting to Mr. Watson for his paper, remarked that they were honoured by the presence of M. Motoni Morimichi, the Japanese *chargé d'affaires*, and of M. Luzuki Kinsou, Secretary of the Legation. The former gentleman had been asked to address the meeting, and had written the following answer:—"The Japanese *chargé d'affaires*, now present, wishes to express his thanks, in the name of his nation, to the meeting for the attention they have shown to this paper treating of the geography of a part of Japan. He regrets that his knowledge of the English language is not sufficient to enable him to address them."

Sir RUTHERFORD ALCOCK said it was a great pleasure to him, as the first Minister to Japan, to find that those who had succeeded him were following so truly in the course which he had been anxious to indicate when he was there, namely, that of studying the people and the country, not only with a desire to obtain the utmost possible information, but with that benevolent and hearty spirit which should always animate those who held diplomatic positions in any country, and more especially in an Oriental country, where there was a totally different civilisation, and where there was large room, not only for sympathy, but for moderation and breadth of view. He had resided in Japan more than five years, under rather trying circumstances, for, though one might get accustomed to carrying one's life in one's hand, it got irksome at times, but he never ceased to feel the greatest confidence in the ultimate power and development of the nation. One of the first traits which struck him was their strong patriotism. With that, of course, an Englishman could not but sympathise. Another trait was their readiness to lay down their lives rather than sacrifice what they felt to be the true aim and object of life. Wherever those two feelings were in any degree prevalent, the nation must certainly, sooner or later, work its way to the foremost rank of civilisation. They saw that their independence was menaced, that they had a powerful neighbour on the north, to whom Yezo offered a beautiful harbour, and that other Treaty Powers, &c., were not always as reasonable as they might be, and they set about adapting themselves to the new state of things with a promptitude which was quite marvellous. Even when he was in Japan, while there was much of fear and animosity, and the natural feeling of hatred that a population would have who felt in danger of being subjugated, they still appreciated that it was necessary that they should put themselves in the comity of nations, and, by assimilating themselves to European customs and habits, enter into international relations which would be their best protection from the oppression of any one power. This was a reach of intellect and of appreciative power which no other Oriental nation had shown itself capable of. The Island of Yezo was inhabited by Japanese only along the coasts, the interior being occupied by the aborigines. Where these aborigines came from was a great mystery. They lived in a semi-savage state, and appeared to have been driven into the mountain fastnesses, as the Welsh and Scotch were when the Romans invaded Britain. They had there preserved a language, and customs and costumes of their own. With reference to the statement that 50 Japanese young ladies were being educated in order that they might marry natives of Yezo, he felt rather sorry for the young ladies. Prince Florestan, who had lately published some charming lucubrations on the subject of new theories of government, said that no Government could be successful, or stable, if the female population were opposed to it and not half the men were willing to support it; and there could be no doubt that, whenever the whole of the women of a country were

opposed to the legislature, there would never be half the men to support it. However, he wished the 50 young ladies every success and happiness. The resources of Japan, considering the size of the islands, were almost unlimited in lead, copper, tin, gold, silver; and the vast forests of Yezo would alone make the fortunes of 50,000 colonists if they could only settle in the country. The chief difficulty to be overcome, however, was that connected with the question of extra-territoriality. No Government with any sense of independence, or self-respect, would ever consent to admit into the interior of the country indiscriminately foreigners who were perfectly independent of the law of the country; but until some compromise was come to on this point, that free access, which was essential for the commercial development of Japan, would never be attained. The mixed courts which had lately been established in Egypt might, however, afford a solution of the difficulty.

Mr. MIRRORD remarked that since Mr. Watson left Japan an official contradiction had been given to the statement that those 50 young ladies were destined to be married to Ainos, and their friends must be very glad to hear of the contradiction. It was not a probable thing that the Japanese should encourage that kind of union, for they looked upon the Ainos with a great deal of contempt, regarding them entirely as an inferior race, and justly so; for, although the Ainos were an interesting and harmless people, they had never shown any capability for development. Many of them had entered the houses of foreigners as servants, and been honest and faithful, but had not evinced any of the cleverness or ingenuity of the Japanese, or any talent for adapting themselves to a higher order of things than that to which they had been accustomed. He had resided for 3½ years in Japan under the old state of things, when he had to sleep with revolvers as bedfellows, but when he went again last summer he was perfectly astonished at the change. On the previous occasion wherever he went he was obliged to take an escort, who were responsible to the Government for his safety; but last year he rode alone from one end of Yedo to the other. A traveller might now travel anywhere in Japan without being subject to the least insult. The Japanese deserved the highest possible credit for the genuine good feeling they had shown to foreigners. The question in extra-territoriality would always be a difficult one. Although it was perfectly intelligible that the Japanese should view with jealousy any wholesale entry into the interior of their country by persons who did not come under their law, and who, not coming under their law, would probably come under no law at all, it was equally intelligible that foreigners should object to submitting to Japanese law as it was at present. Europeans could not approve of the Japanese methods of punishment and torture. The Japanese *chargé d'affaires* would do good service to his State if he would, so far as in him lay, encourage the study of law by those students who visited this country. If a system of European law could be introduced into Japan, the difficulty with regard to the question of extra-territoriality would soon be overcome.

Sir HARRY VERNEY reminded the meeting that it was owing to Mr. Watson's representations that a severe blow had been given to the kidnapping of coolies, who were formerly taken to the harbour of Hakodade.

*Tenth Meeting, 13th April, 1874.*

The RIGHT HON. SIR H. BARTLE E. FRERE, K.C.B., K.C.S.I., ETC.,  
PRESIDENT, in the Chair.

PRESENTATION.—*E. H. Winslow, Esq.*

ELECTIONS.—*The Earl of Antrim; N. St. B. Beardmore, Esq.; Lieut.-Col. G. W. Boileau; Rev. Dixon Browne; P. Carnegie, Esq.; M. E. Clark, Esq.; R. Clutterbuck, Esq.; Lieut.-Col. A. W. Durnford, R.E.; Commander C. E. Foot, R.N.; Ellis Gilman, Esq.; Sir Charles A. Hartley; Capt. H. B. Johnston; Edwin Jones, Esq. (Mayor of Southampton); Major-General Lord Mark Kerr; Rev. Cornish R. K. Kestell (Missionary Bishop for Madagascar); Dr. Alfred Meadowes; P. Protheroe, Esq.; Capt. H. F. W. Rumbold; Geo. W. Rusden, Esq.; O. C. Stone, Esq.; Capt. Chas. Vincent (late Indian Navy); Col. F. G. Whitehead.*

ACCESSIONS TO THE LIBRARY FROM MARCH 23RD TO APRIL 13TH, 1874.—‘Dahomey as it is.’ By J. A. Skertchley. Donor the author. ‘Khiva and Turkistan’ (translated from the Russian). By Capt. H. Spalding. Donor the author. ‘Kaspische Studien.’ By K. von Baer. Donor the late Sir R. I. Murchison. ‘Bibliotheca Nicotiana.’ By William Bragge. Donor the author. ‘Report on the Prybilow Group, or Seal Islands of Alaska.’ By Henry W. Elliott. Donor Hon. J. Richardson, through I. Gerstenberg, Esq., F.R.G.S. ‘Reisen nach dem Nordpolarmeer.’ Part 3. Fauna, Flora und Geologie. By M. Th. von Heuglin. Donor the author. ‘Cours gradué de Géographie.’ By J. du Fief. Donor the author. ‘Four Catalogues of the Land, Marine, and Fossil Mollusca of New Zealand.’ Donors the Colonial Museum and Geological Survey Department. ‘Les Explorations sous-marines.’ By Jules Girard. Donor the author. ‘The Dolomite Mountains.’ By Josiah Gilbert and G. C. Churchill. By purchase. ‘Aperçu de l’Histoire d’Égypte;’ ‘Itinéraire de la Haute-Égypte;’ ‘Notice des principaux Monuments, &c., du Musée de Boulag.’ By A. Mariette-Bey. ‘Handbook to the River Plate.’ By M. G. and E. T. Mulhall. ‘Memorias Historico-Políticas del Jeneral J. P. Gutiérrez.’ ‘Mexico: Landscapes and Popular Sketches.’ By C. Sartorius. Donor, C. H. Wallroth, Esq. ‘Civitas Londinum’ (Ralph Agas). By W. H. Overall (facsimile). By purchase. ‘The Great Ice Age.’ By James Geikie. By purchase. ‘Preliminary Report of the U.S. Geological Survey of Montana.’ By F. V. Hayden. Donor the Librarian.

ACCESSIONS TO THE MAP-ROOM SINCE THE LAST MEETING OF MARCH 23RD, 1874.—Map of Victoria, Australia, showing the distribution of Forest Trees. Compiled by Arthur Everett, under the direction of R. B. Smyth, F.G.S. On 2 sheets. Presented by the Author. Africa.—Ancient Maps at different periods. On 2 sheets. By H. Kiepert. 1873. Presented by the author. Indian Survey. On 39 sheets. Presented by the Secretary of State for India. Central Asia.—Map of Maghian. By A. P. Fedchenko. (In Russian characters.) Presented by the author.

The PRESIDENT said that, since the last meeting, the remains of Dr. Livingstone had arrived close to his native shores, and they might be expected to be landed at Southampton to-morrow morning, though, up to the present moment, the steamer had not been signalled. The members of the Council, who had been deputed to receive the body from the steamer, viz., General Rigby and Colonel Graunt, were still detained at Southampton. The management of the funeral would be entrusted to the representatives of the family, the two gentlemen already mentioned, selected from the Council (assisted by Mr. Bates), and to the Rev. Horace Waller, who was an old companion of Livingstone, and Mr. Hutchinson, who represented the Church Missionary Society; the representatives of the family were Mr. W. F. Webb, the tried and trusted companion of Livingstone's early journeyings, who had been chosen by the family to speak their wishes with regard to everything connected with the funeral obsequies of the great traveller. As soon as they knew the facts of the case, Her Majesty's Government came forward in a most willing spirit to defray the cost of the funeral out of public moneys, and they requested that the Committee of the Society, and those who had been named by the family to represent them, would attend to the details, and act on behalf of the Government—a sum being placed at their disposal which, it was hoped, would be quite sufficient to cover all expenses. The general feeling of Dr. Livingstone's countrymen was expressed by a merchant of London, who, through Mr. Russell Gurney, offered to bear the whole expense of the funeral, whatever it might be; but Her Majesty's Government had already determined that the expense should be borne as a public charge by the Government. Next Saturday (April 18th) had been selected by the Dean of Westminster as the fittest day for the funeral, and by that time, no doubt, all due preparations would be made. The gentlemen who had undertaken the duty on behalf of the Royal Geographical Society, and those who represented the family, would do everything the means at their disposal would allow, to enable not only the members of the Society, but all who shared their feelings towards the deceased, to show their respect to the great man who had left them.

A letter had been received from Mr. Holmwood, Assistant to the Consul-General at Zanzibar, giving a brief account of what was known at Zanzibar regarding the last days and travels of Dr. Livingstone; but, of course, it was a mere sketch, and everybody who was interested in the work he was engaged in would be glad to know that an immense mass of information had been safely brought to England, which it had been the labour of the latter years of his life to accumulate, and which, there was every reason to hope, would throw ample light upon all his wanderings, their persistent direction towards one great end, and the unflinching courage and perseverance with which he worked towards that end. When his literary remains were collected and examined by competent geographical authorities in this country, they would form a monument to his memory such as no other traveller in our day, or even for ages past, had left behind him. It was the unanimous wish of the Council of the

Society that, at the earliest possible moment, all the letters and other papers at their disposal should be made available to the public through the Society's 'Proceedings,' and as early a day as possible would be fixed for the reading of some of the more prominent letters.

Rev. Dr. BADGER asked what amount the Government had placed at the disposal of the Society to meet the expenses of the funeral.

The PRESIDENT said that the sum was one which the Government had every reason to expect would be ample for the purpose; but, if it should prove insufficient, he was quite sure that there would be no shortcomings on the part of the Government, and that whatever was required would be supplied.

The following letter was read :—

1.—*Majwara's Account of the Last Journey and Death of Dr. Livingstone.*

By F. HOLMWOOD, H.B.M. Consulate, Zanzibar.

"MY DEAR SIR BARTLE,—

"Zanzibar, March 12th, 1874.

"No doubt you will hear from several interested in Dr. Livingstone; but, as I do not feel sure that any one has thoroughly examined the men who came down with his remains, I briefly summarize what I have been able to glean from a careful cross-examination of Majwara, who was always at his side during his last days, and Susi, as well as the Nassik boys, have, generally, confirmed what he says. I enclose a small sketch map, merely giving my idea of the locality, and have added a dotted line to show his route during this last journey of his life.

"The party sent by Stanley left Unyanyembe with the Doctor about the end of August, 1872, and marched straight to the south of Lake Tanganyika, through Ufipa, crossing the Rungwa River, where they met with natural springs of boiling water, bubbling up high above the ground. On reaching the Chambezi, or Kambezi, River, they crossed it about a week's journey from Lake Bemba, also crossing a large feeder; but, by Susi's advice, Livingstone again turned northward, and recrossed the Kambezi, or Luapula, as he then called it, just before it entered the lake.

"He could not, however, keep close to the north shore of Lake Bemba, owing to the numerous creeks and streams, which were hidden in forests of high grass and rushes. After making a détour, he again struck the lake at a village, where he got canoes across to an island in the centre, called Matipa. Here the shores on either hand were not visible, and the Doctor was put to great straits by the natives declining to let him use their canoes to cross to the opposite shore. He therefore seized seven canoes by force, and when the natives made a show of resistance, he fired his pistol over their heads, after which they ceased to obstruct him. Crossing the lake diagonally, he arrived in a long valley, and the rains having now set in fully, the caravan had to wade, rather than

walk, constantly crossing blind streams, and, in fact, owing to the high rushes and grass, hardly being able to distinguish at times the land, or rather what was generally dry land, from the lake.

"Dr. Livingstone had been weak and ailing since leaving Unyanyembe, and when passing through the country of Ukabende, at the south-west of the lake, he told Majwara (the boy given him by Stanley, who is now in my service) that he felt unable to go on with his work, but should try and cross the hills to Katanga [Katanda?], and there rest, endeavouring to buy ivory, which in all this country is very cheap (three yards of merikani buying a slave or a tusk), and returning to Ujiji through Manyuema to recruit and reorganise.

"But as he approached the northern part of Bisa (a very large country), arriving in the Province of Ulala, he first had to take to riding a donkey, and then suffer himself to be carried on a kitanda (native bedstead), which at first went much against the grain.

"During this time he never allowed the boy Majwara to leave him, and he then told that faithful and honest fellow that he should never cross the high hills to Katanda.

"He called for Susi, and asked how far it was to the Luapula, and, on his answering 'three days,' remarked, 'he should never see his river again.'

"On arriving at Ilala, the capital of the district, where Kitambo the sultan lived, the party were refused permission to stay, and they carried Livingstone three hours' march back towards Kabende. Here they erected for him a rude hut and fence, and he would not allow any to approach him for the remaining days of his life except Majwara and Susi, except that every morning they were all desired to come to the door and say 'good morning.'

"During these few days he was in great pain, and could keep nothing, even for a moment, on his stomach. He lost his sight so far as hardly to be able to distinguish when a light was kindled, and gradually sank during the night of the 4th May, 1873.

"Only Majwara was present when he died, and he is unable to say when he ceased to breathe.

"Susi, hearing that he was dead, told Jacob Wainwright to make a note in the Doctor's diary of the things found by him. Wainwright was not quite certain as to the day of the month, and as Susi told him the Doctor had last written the day before, and he found this entry to be dated 27th April, he wrote 28th April, but on comparing his own diary on arrival at Unyanyembe he found it to be the 4th of May; and this is confirmed by Majwara, who says Livingstone was unable to write for the last four or five days of his

life. I fancy the spot where Livingstone died is about 11° 25' S. and 27° E.; but, of course, the whole of this is subject to correction, and, although I have spent many hours in finding it all out, the Doctor's diary may show it to be very imperfect.

"I fear you will find this a very unconnected narration, but my apology must be that the Consul-General is not well, and the other Assistant absent on duty, and there is much work for me to do. Mr. Arthur Laing has been entrusted with the charge of the remains and diaries, which latter he has been instructed to hand to Lord Derby.

"Trusting that you are in the enjoyment of good health, and with great respect,

"Believe me, dear Sir Bartle,

"Your most obedient servant,

"FREDERICK HOLMWOOD.

*"To the Right Hon. Sir Bartle Frere, K.C.B., G.C.S.I., &c., &c.,  
"President of the Royal Geographical Society."*

Mr. A. LAING (who accompanied the remains from Zanzibar to Suez) said he had had many opportunities of conversing with Jacob Wainwright, one of the Nassik boys sent up by Stanley from the coast to meet Livingstone, and his story confirmed what Mr. Holmwood had written. Jacob Wainwright said that the Doctor paid great attention to his boys, and was very much beloved by all of them. When any of them were sick, he would wait a day or two until they were able to move on; but, when the boys saw that he was failing, he would not allow them to wait for him, but, at first, rode on a donkey, and, when unable to undergo even that fatigue, was carried in a kitanda. Jacob Wainwright writes and speaks English very well, and has kept a full diary from the time of Livingstone's death to the arrival of the body at Zanzibar.

The following paper was then read by the author:—

2.—*On the Valley of the Ili and the Water-System of Russian Turkistan.*  
By ASHTON W. DILKE.

THE shape of the valley of the Ili, like that of the present Khanate of Kokan, which it resembles very closely, is eminently calculated to make it play a very important part in the development of Russian Turkistan. At present the political situation of the country prevents the Russians from paying such attention to it as they probably will when some arrangement has been made with the Chinese; for, as yet, the Russians only consider themselves as holding Kuldja with the view of restoring it to the Chinese, if the latter ever regain their footing in Kashgar or the neighbouring parts of Mongolia, which is very doubtful. The natural frontier seems to be the watershed of the Ili, which is one of the Seven Rivers which give their name to the country, and which is cut off from the remainder of

China by extremely abrupt mountains, and opens out only in the one spot where the Ili finds its outlet to the Balkash. I was unable to find any accurate maps or measurements of the district of Kuldja, but I saw enough to be convinced that all our present maps are exceedingly inaccurate, especially in the point of representing the breadth of the valley too great in comparison with its length. The valley rises in a gentle slope from the Ili, which flows nearly in the centre of it, to the mountains on either side, which are not more than 50 miles apart, while from the commencement<sup>of</sup> of the valley at Altyn-Emel to Old Kuldja, the chief Russian post, is a distance of about 170 miles, according to the distances in the postal register; and from the latter town the mountains to the east can only be seen in bright weather at sunrise or sunset, which, calculating as usual in this dry air, gives a distance of about 120 miles, making the total length of the valley nearly 300 miles, or about six times its breadth. The mountains to the north of this plain rise to a height of some 12,000 feet, and are tipped with snow in July. There are two main roads across them: one from Old Kuldja direct to Djin-Ho, about 160 miles, but with a waterless passage of nearly 70 versts in the centre; the other is the old Chinese post-road, from the ruined capital of New Kuldja, through Soidoun, one of the other Russian posts, to the valley of Talki, up which it runs a distance of 20 miles to Lake Sairam-Nor, which lies at a height of over 7500 feet. The road was evidently kept in excellent repair by the Chinese, as the remains of bridges and post-stations, which are frequently met with, prove. It is now only used by the Kirghis, who live in summer in the mountains, and by an occasional caravan going to Manas or Urumtsi. Sairam-Nor lies in extensive pastures, which are watered by the melting of the snows in the mountains on the western side, though as the lake never rises or falls, in spite of the considerable mass of waters which it receives, the Kirghis have invented the usual theory of a subterranean outlet, which nothing seems to justify. Standing on the southern side of the lake, where the Talki Pass comes on to it about 500 feet above its level, we see the openings of three valleys: the first, beginning from the right, is that of the Kizim Tchik, a narrow and very lovely ravine, running down to Mongolia on the northern side of the mountains which separate Kuldja from Djin-Ho, nearly up to this latter place; then, still on the right or eastern side of the lake is a valley along which the Chinese road finds its way—a broad waterless valley, only marked on the latest Russian map as a "Dry Valley." It runs parallel to that of the Kizim Tchik, and leaves the mountains not far from the spot where the latter also does, close to the little town of Takianzi,

and within sight of Djin-Ho. Exactly opposite the entrance of the Talki Valley on to Sairam-Nor is a break in the mountains, about 20 miles distant across the lake and close to its shore, which allowed me to catch a beautiful glimpse of the long chain of the Northern or Tchungurski Alataon, close to Lipsa, across the deep valley of the Baratola, which gives the idea of some unfathomable gap between the nearer dark mountain-range and the bright peaks beyond it. The mountains are almost everywhere 3 or 4 miles, and in some places recede 10 miles from the lake, which is about 60 in circumference, and the effect of its blue depths, set in green meadows, with the black forest-clad mountains all round running up to snowy heights beyond, is extremely lovely.

The valley of the Kizim Tchik, which I descended, is either very narrow or very broad, as it may be taken—*i.e.* the distance between the snowy peaks on either side is considerable, as we saw whenever we got a glimpse out of our prison below; but the little stream itself is blocked in a ravine full of the most luxuriant vegetation, from which cliffs, in many places 1500 feet in height, rise perpendicularly, and effectually bar the view. The valley at length grows broader and the cliffs become bare masses of brown sand, quite abrupt and of some elevation, but bare of vegetation, and terrible reflectors of the scorching sun. Phalangas and tarantulas swarm. At length, after about 80 miles, the valley opens out into the plain. To the south, not far off, are the snowy mountains between the upper valley of the Ili, or rather that of the Kash, and Djin-Ho: the latter town appears under a promontory of the mountains as a mass of green reeds, and to the extreme left I thought that I could distinguish the Lake Ebi-Nor, though the haze and mirage may have misled me. The Kizim Tchik River, here about 15 yards in width and 4 feet deep, makes a sudden bend to the north, and either loses itself in sands, or, when full of water, reaches the Baratola in a marsh, when the latter is almost indistinguishable from the Ebi-Nor. The lake is extremely salt and bitter, very shallow, so that it is possible to ride out some distance in it, and surrounded by beds of salt and reeds, mosquito- and fever-haunts. Though it receives the Baratola and the Kar-Kara-Usu, two large rivers, the natives assert that it is drying up rapidly, as, in fact, all the salt lakes here are doing, the Balkash and Ala-Kul having been connected no long time back. The valley of the Baratola is formed by the union of three considerable rivers, which rise in the corner of the Alataou, near Kopal, and flow nearly 130 miles before falling into the Ebi-Nor.

Returning to the valley of Kuldja, I may briefly mention that it is intended to introduce two little steamers on to the Ili this year

in all probability, though the distance from Semipalatinsk, on the water-system of Siberia, to the Balkash, is so great as to make it doubtful whether anything would be saved by them. The wealth of coal in the valley is immense, and the Chinese are known to have worked silver and gold with great profit; but it must be remembered that they had the advantage of slave labour, and that capitalists will be chary as yet of embarking in ventures on the Ili. I had no less than three offers made to me, in my quality as an Englishman, of untold riches and gold mines of fabulous extent, if I would only find the capital.

The Ili, which opposite Kuldja is about a quarter of a mile in breadth, and both swift and deep, is formed by the union of three main tributaries, the Kash, the Kunges and the Tekes. The Kash joins it not far above Kuldja, near a high butte or isolated hill, which forms a landmark for the whole plain: it flows from east to west, as does also the Kunges; but, in spite of this, the Tekes, being the most considerable of the three, is generally considered as the upper Ili. It rises not far from Issyk-kul, between that lake and the Musart Pass to Aksu, which lies under Khan-Tengri, the highest peak of the Thian-Shan, and flows nearly due east for about 100 miles, bending to the north round the last spurs of the Trans-Ilian Alataou about 70 miles from Old Kuldja, at its junction with the two above-mentioned rivers. The valley of the Tekes is uninhabited, except by a few nomad Kirghis and Kal-mucks, and by panthers and wild boars, with occasional tigers, who find shelter in the enormous reed-beds which border the river. The valley is, on an average, about 40 miles in breadth, but decreases very rapidly near the Musart, where it enters the mountains.

In passing from the Tekes to Issyk-kul I crossed the watershed of the Tcharyn, which flows through a break in the Trans-Ilian Alataou into the Ili, which is here only some 70 miles distant in a straight line, and further on an abrupt ridge of rocks divides this again from the basin of Issyk-kul. The first view of this lake is very magnificent. The mountains rise from its very waters on every side; the Alataou to the north at a height of about 15,000 feet, and the Thian-Shan to the south about 18,000 feet, form two almost unbroken walls which reduce the immense breadth of the lake, nearly 40 miles, to nothing when seen from this elevation. The mountains at the other end of the lake, 110 miles away, show their peaks above the horizon of the waters so clearly outlined as to make them look within a few hours' ride.

Issyk-kul, the "hot lake," lies at a height of over 5000 feet above

the sea, about 60 miles from Vernoe at its nearest point, and about 250 from Kashgar. It is called Issyk-kul, or hot lake, from its never freezing, which fact is accounted for by the number of hot springs in it, making it impossible even to bathe in certain places, according to my informants. The water is very clear but slightly salt, though drinkable; it swarms with fish, which form the chief article of food for the Russian peasants who have colonized the valleys of the streams running into it. From Karakol, the chief Russian settlement at the east end of the lake, a little-known pass runs to Kashgar across the mountains; but the pass through the fort of Naryn, which is passable by the native carts, is universally preferred to it. Before the Russians occupied the Musart, the trade between Kuldja and Kashgar, to avoid Russian interference, went over that pass, which is so difficult that the horses have to be let down tied with ropes over one place; but now that the Russians have seized all the passes, the natives prefer the easier one through Fort Naryn. So unbroken is the chain of this huge range that the passes from Tashkend to Manas may be counted on one's fingers; only two, that from Aulie-Ata to Kokan, and from Vernoe to Kashgar through Fort Naryn, being fit even for the 9-foot wheeled arba, or carts, of the Sart traders.

In connection with Issyk-kul a very ingenious, and probably correct theory, has been made by Colonel Tchaikovski, of Samarcand. At present the Tchui—a swift and deep river which flows in a bed much larger than its present size would seem to allow it—passes close to Lake Issyk-kul, divided from it only by a narrow ridge. Issyk-kul, as we know from the Chinese records, was formed by some convulsion of nature about 150 years back. The valley appears to have been thickly populated, judging from the remains of villages which are clearly to be seen under the water in several places, and from the fact that money and bones are not unfrequently washed up to the shore. Even a Spanish gold piece was once found in it. The depth of the lake is immense, judging from the inclination of the shores and the few soundings which have been taken, and the body of water in it must be enormous. The Tchui, after leaving the ravine of Buam near Issyk-kul, flows through miles of steppe and sand, and loses itself in the Lake Saimal-kul, which is only a few miles from the Djemman-Daria, part of the Syr-Daria. The formation of this marsh—for it is now little more—indicates that the Tchui once must have flowed on into the Syr-Daria. Now, from the opposite side of this dried-up lake on the Syr starts the old course of the Syr, called the Yani-Daria, which on most maps is only marked as reaching about half-way

to the Amu-Daria, but which was traced by the late expedition for the whole distance between the two rivers. This, again, falls into the Amu, almost exactly opposite the spot where the old course of that latter quits it for the Caspian. It will be seen that if the course of the Tchui be prolonged, following the curve of its course from Issyk-kul to Saimal-kul, it would follow exactly the course which I have pointed out. May we not, therefore, conclude that not long ago the waters of Issyk-kul overflowed into the Tchui, and that that river, swollen to many times its present size, formed, together with the Syr and Amu, a stream sufficiently large to reach the Caspian. This theory disposes of the idea that the Amu by itself has not enough water to reach the Caspian, which has been urged against the scheme of turning the river into its former bed. The more I have thought over this idea, the more the simplicity and probability of it has forced itself into my mind, and an examination of the land between Saimal-kul and the Djemman-Daria showed distinct traces of water upon it at a period not far back. All this strip of land is lower than the adjacent country, covered with marshes, half-dried pools, which any rain turns into lakes and reed-beds, bearing witness to the fact that a great river once flowed here. To drain Issyk-kul would be a task beyond almost any Government, not to speak of one so feeble as Russia in Turkistan, and to regulate the outpour of its waters into the Tchui would be almost impossible.

I did not myself pass through the ravine of the Tchui near Lake Issyk-kul, but all the persons with whom I spoke agreed in saying that it has no connection with the lake. I knew that in many maps a little junction was marked, but knowing also how frequently it happens that, when a river passes close to any lake, some adventurous geographer inserts a connection which does not, in reality, exist, I considered that it must have been so in this case also. I now, however, find in Colonel Wrigman's translation of Von Hellwald's work the following passage:—"It (Issyk-kul) was long considered as the original source of the Tchui; but only a small *affluent* of the Tchui, the Kutemaldy, flows *into* this mountain-lake." I do not know whether the mistake is that of the author or of the translator; but, even allowing that "out of" should be read for "into," he would contradict himself by saying, as he does, that "a small plain, gently sloping towards the *east*, lies between the lake and the Tchui," in which case this supposed affluent would flow up-hill. If the words are correct, the Tchui would divide into two branches, one falling into Issyk-kul, and the other passing on to the plain below, which, I believe, never

happens,—never, at all events, with a stream so swift as the one in question.

I need hardly point out the importance of this to the Central Asian question. The turning of the Amu-Daria has often been mooted, and the chief reason against it has been the want of water to allow its navigation from the Caspian: whereas, if this volume of water could again be poured into it, we may consider that it would, at all events, be sufficient for floating rafts, or the little steamers which on the Syr-Daria now cross places less than 4 feet deep. The superiority of such a route over the present roads, or even over the projected railway, would be considerable, as the native merchants care very little for speed of traffic, and a great deal for its cheapness.

Another fact that I would wish to call attention to is that Russia has it in her power at any moment, without sending a single man beyond her frontiers, to make all Bokhara perish miserably. At the present time the authorities of Bokhara send occasional statements to the governors of Samarcand as to the quantity of water which is required in Bokhara, acting on which the governor orders the aryks or irrigation-canals in the district of Samarcand to be opened or shut for so many days. By turning the Zarafshan into these canals, a step which could be taken in two days, not a drop of water would reach Bokhara.

The PRESIDENT said the Society was greatly indebted to Mr. Dilke for his lively and interesting paper. The heart of every householder must have been moved when he alluded to the price of coal at Kulja. He (the President) regretted the absence of Sir Henry Rawlinson, who probably knew more of Central Asia than any other man living, but who, he hoped, would, on some future occasion, favour the Society with the results of his reading.

General GORLOFF said that Kulja was not taken from the Chinese, between whom and the Russians the best relations had always existed, but from the Taranchees. The Dungans overthrew the Chinese, and then the Taranchees rose against the Dungans; but, when their power was established, they, together with the Kirghis, commenced depredations on the Russian territory, and these increased to such an extent that they could no longer be endured, and Kulja was, therefore, occupied.

Mr. T. SAUNDERS said he could not agree with Mr. Dilke that the position of Kulja, as regards the River Ili, and the outfall of that river into the Balkash, at all qualified it to be a Russian more than a Chinese town. Although the Ili really falls into the low plain occupied by the Russians, yet it comes from a plateau of considerable altitude, and has to break through the range of mountains connecting the Thian Shan with the Altai Mountains, before reaching the Russian frontier. He could not see that the possessors of a great plateau should be called upon to surrender its possession simply because the rivers from that plateau fall into a plain below. Neither was there anything to warrant the conclusion that it would be better for the inhabitants to exchange the Government of the Chinese for that of the Russians. Mr. Dilke stated that the magnificence of the roads astonished him, that he found coal worked there, and that there were other evidences of the development of industry

under the Chinese : but he qualified his statement by associating those works with slave-labour. It should, however, be remembered that it was the chief seat of the great cotton establishments of the Chinese in that region, and the so-called slaves were, in fact, serfs transported thither by the Chinese, just as England used to send her convicts to Australia. Further than this, Mr. Dilke thought it would be in the interest of civilization that Pukhara should be occupied by the Russians : but England had an interest likewise in this matter ; and just as far as the Russian frontier line extended so far was the trade of all the other European nations extended. It used to be the custom to obscure that fact by naming the military headquarters with regard to the invasion of India by the Russians, but it might be safely said that the Russian advance to the southward of the Syr-Daria had been a matter of very serious import to the trade of all the maritime countries trading with the shores of Asia. From all the shores of Western Asia a considerable trade had been carried on by native carriers with the centre of the continent : but so far as that trade passed through Buchara, and Samarkand, and Kulja, it had been stopped by the Russian occupation of the countries to the south of the Syr-Daria. The proper relations of the Kutenaldy to Lake Issyk and the Tekei rivers was long ago described by Russian writers. It is merely an overflow canal, and the lake is not usually connected with the Tekei.

Mr. DILKE said that General Count Gorloff's statement with regard to the occupation of Kulja was perfectly correct, and the Russians are only holding Kulja until the Chinese claim it : but it seemed very doubtful if they would ever do so. The Taranchi Government in the district of Kulja lasted four years, and the Russians were perfectly justified in driving them out, as they inveigled a considerable number of Russian subjects over to their side. Mr. Saunders had spoken of the Ili breaking through the mountains, and leaving a plateau ; but he must have been misled by the maps. The breadth of the valley, at the place where the Ili leaves the mountains, must be quite 60 English miles, and the height of Kulja is very insignificant, for the fall of the river from Kulja to the Balkash is not more than a few hundred feet. The district, therefore, belonged to Russia quite as fairly as the Seven Rivers district, of which it formed a part. Ili was certainly a Chinese penal colony : but it was a sort of Siberia, where the people were not made to work as slaves in mines, but were allowed to carry on business in the towns. The Taranchis were quite a different race ; they were the slaves of the Chinese, and were not rewarded with any wages beyond a certain quantity of land. He had no doubt that Mr. Saunders' explanation of the Kutenaldy was correct, because it satisfied all the conditions. The natives of Samarkand, though they knew that he (Mr. Dilke) was an Englishman, assured him that they preferred Russian to English goods ; for, though the English goods were better than the Russian, the manufacturers in Russia knew how to suit the native taste better than the English manufacturers.

Mr. ROBERT MICHELL expressed a hope that Russia would, ere long, see fit to withdraw the prohibition against English travellers in the Russian territories of Central Asia.

The PRESIDENT thought that the difficulties to be encountered in visiting those regions must be somewhat over-estimated. Not long ago Khiva and Kulja were places no European could show his face in without the risk of losing his head, but recently Mr. Dilke had returned in safety from Kulja ; Mr. Robert Michell had also travelled in that direction, and Mr. McGahan, who was present at the meeting, had been to Khiva and back.

*Eleventh Meeting, 27th April, 1874.*

The RIGHT HON. SIR H. BARTLE E. FRERE, K.C.B., K.C.S.I., ETC.,  
PRESIDENT, in the Chair.

PRESENTATIONS.—*Walter Spencer, Esq.; G. P. Moodie, Esq.; C. E. Baring Young, Esq.; Edmund Walburn, Esq.*

ELECTIONS.—*Walter Raleigh Browne, Esq.; R. S. Faulconer, Esq.; Joshua Fielden, Esq., M.P.; M. Buller Johnstone, Esq., M.P.; Lord Rayleigh; J. B. Taylor, Esq.; Charles Evan Thomas, Esq.; Rev. William Wayte.*

PRINCIPAL ACCESSIONS TO THE LIBRARY FROM APRIL 13TH TO APRIL 27TH, 1874.—‘Ueber Topographie und topographische Karten.’ By Dr. Ziegler. Author. ‘Historical Maps of England during the first Thirteen Centuries.’ Pearson. ‘The English Cyclopædia:’ Geography (and Supplement). Knight. ‘Words and Places.’ Taylor. ‘The History of Japan.’ Vol. I. F. O. Adams (author). ‘Dictionnaire de Géographie, etc., à l’usage du Libraire.’ Anon.

ACCESSIONS TO THE MAP-ROOM SINCE THE LAST MEETING OF APRIL 13TH, 1874.—Index to the Charts of England and Ireland published by the Hydrographic Department of the Admiralty. Presented by the Hydrographer, Captain F. J. Evans, c.b. Map of parts of the Idaho, Montana, and Wyoming Territories. Presented by F. V. Hayden, U.S. Geologist. Map of Montana and Wyoming Territories. Presented by F. V. Hayden, U.S. Geologist. Map of the Sources of the Snake River, &c. Presented by F. V. Hayden, U.S. Geologist. Three Sheets of Sheda’s new Map of Central Europe, 578000; five Sheets of Hauer’s Geological Map of the Austro-Hungarian Empire, 578000; eleven Sheets of Administrative Map of Lower Austria, 788000; Hypsometrical General Map of the Alps. By purchase. Map of Equatorial and South Africa; including the Discoveries of Dr. Livingstone, and the Diamond and Gold Fields, &c. By A. Bellville, F.R.G.S. Presented by the author. Part IV. of an Historical Atlas of Ancient Geography, Biblical and Classical. By Dr. Wm. Smith and Mr. Grove. Presented by J. Murray, Esq. A Government Map of Victoria. Presented by A. Michie, Esq., Agent-General for Victoria.

On taking the chair, the PRESIDENT introduced to the meeting Mr. T. S. Livingstone, the eldest son of Dr. Livingstone, and Jacob Wainwright, one of the faithful followers of the great traveller. He then said that the subject to be laid before the meeting was the travels of Livingstone, and the papers consisted mainly of extracts from his correspondence with friends at home. These letters were fragments of a correspondence extending over six or seven years, during a time when Livingstone was utterly unable to say when, if ever, his letters would reach their destination. It was almost

impossible to imagine a greater proof of his indomitable perseverance than that he continued to write under such intense discouragements. Nothing but a sense of duty to those who shared his feelings regarding the great work he had in hand could possibly have induced him to continue writing as he did, without any certainty that his letters would ever reach those for whom they were intended. Many years elapsed without his hearing from his own countrymen, until at last Mr. Henry Stanley relieved him. The letters afforded no connected narrative of discovery; but from the very voluminous materials which had been preserved through the courage and perseverance of those who brought with them every fragment belonging to their master, it was hoped that in time such a narrative might be constructed, and that no important point to the elucidation of which his life was devoted would remain unillustrated. This must necessarily, however, be a work of time; and everyone interested in geography would be glad to hear that the work of editing the remains which his father had left behind him, in the shape of journals and correspondence, had been undertaken by his most worthy son, Mr. T. S. Livingstone, who had given up for a time a very promising career in Egypt to perform this pious duty to his parent, to his country, and to all mankind. In the letters which would be read would be found perpetual reference to small points, regarding which his friends had been most anxious. There was an ever-manifest yearning for home, a devotion to duty, and a determination that nothing should induce him to give up the work which he had undertaken, until that work was properly performed, as far as his powers went. Here and there were fragments of most picturesque description of the country he passed through,—invaluable materials for constructing a detailed account of the physical geography and ethnography of the country. Jacob Wainwright had himself contributed very valuable materials in the shape of a journal, such as he was enabled to keep through the education which he received at the hands of the missionaries of the Church Missionary Society at Nassik; and this, with the aid of such illustration as it might receive from his oral communications, and from the notes of previous journeys in or near the same part of the country, would, it was hoped, enable Mr. Livingstone to draw out a connected narrative of the route by which the body of the great traveller was brought home. Upon the whole, he expected that, when the work was before the public, it would prove such a complete picture as the great traveller would himself have wished his countrymen to possess of the work to which his life was devoted. It was impossible to give to the Society any adequate notion of the general enthusiasm with which the country at large had taken the same view which the Society took with regard to their duty to their great countryman. From every part of the kingdom assurances had been received that the feelings which actuated the Royal Geographical Society in undertaking the duties of the last fortnight were shared by their countrymen at large. From the Queen in her palace, from the several members of the Royal Family, down to the workman in his cottage, there had been but one expression of feeling on the subject, and he was glad to think that that feeling was fully shared by Her Majesty's Government.

The following letters of Dr. Livingstone were read:—

1.—*To Sir H. BARTLE E. FRERE, K.C.B.*

“MY DEAR SIR BARTLE,—

“Manyuema Country, October, 1869.

“I have not the faintest prospect of sending a letter for many months to come; but I make a little preparation for the time when

the bustle of sending off a packet may arrive. It is refreshing also, when brought occasionally to a standstill, to hold a little converse on paper with one's friends, and make believe that progress is reported. I am in the country of the Manyema—the Suaheli say Manyema—the reputed cannibals, and about 150 miles west of Ujiji. As soon as I was recovered from pneumonia, I went up Tanganyika, 50 miles, to an islet called Kasenge, and then struck north-west. This was to avoid a great mass of high mountains opposite Ujiji. I had seen the central line of drainage of the great Nile Valley pass through Lake Moero, and thence go away north-west as the Lualaba. It was reported to enter another lake there, and was joined by the River Lufira therein. On coming out it was said to flow west, but no one knew whither. I imagined that it might be the Congo; but I have since found, in coming west, that I am in the great bend this river—which still retains the name Lualaba—makes before turning round and going north and north-east into, I suppose, the Nile. It is a very large river, sometimes from 8 to 10 miles broad. I have to go down and see where it joins the eastern arm. Lualaba and Tanganyika are evidently the two great head-branches into which Ptolemy makes the headwaters collect. I would call them Lacustrine rivers—extant specimens of the lake-rivers which abounded in Africa in pre-historic times. Slowly and surely has the light dawned on my mind that the predecessors of Ptolemy the geographer, who flourished in the second century of our era, must have visited this very region; and all they have left for us moderns is the *re-discovery* of what had sunk into oblivion, like the circumnavigation of Africa by the Phœnician admiral of one of the Pharaohs, about B.C. 600. He was not believed, because he said that, in passing round Libya, he had the sun on his right hand. This stamps his tale to us as genuine. Ptolemy, by placing the springs between 10° and 12° S. lat., and exhibiting the water collected into two great arms, showed that his informants had visited the sources. They were probably traders in ivory, tamed elephants, slaves, copper, and gold. A map of the Ethiopian gold-mines of the time of Sethos II. is the very oldest in the world. The copper-mines of Katanga, on my south-west, have been marked for ages, and the malachite is said to be inexhaustible. Bible commentators have been strangely afraid to place Ethiopia further up than Nubia; some have ventured to put a patch of it adjacent to the Red Sea. If I remember rightly, 'Tirhaka the Ethiopian' had his seat of empire on the Euphrates: he must have had a large slice of Africa to merit his name. Sir H. Rawlinson thought it was like the Imaum of Muscat with his African possessions. I am

not without hopes that the lost city of Meröe may have existed at the confluence of Lualaba and Tanganyika; the extensive underground houses reported may have been places of sepulture of a race which has left no descendants. The excavations are ascribed to the deity, and the modern inhabitants build their rude huts inside. These are my waking dreams; but they will not divert my mind from following the line of discovery—to whatever it may lead. Sir Roderick, by desiring me to examine the watershed of South Central Africa, pointed to the true scientific way of settling the question of the sources. I understood it to be the wish of the Council too, but have since had doubts. He said to me, ' You will be the real discoverer of the sources of the Nile.' You will not readily conceive the difficulty. I had to feel every step of the way, and was generally groping in the dark; for who cared where the rivers ran. The great upland valley revealed itself to the barometers, and then the courses of the rivers proved it. I am a little anxious that my friends should understand my reasons for striving to make a complete work of the exploration. I have had no letters but very old ones, and don't know the state of my affairs or of my family: the only thing I am sure of is, that all my friends will wish me to complete my task before I retire. In this wish I join, and think it better to do so now than afterwards in vain. It seems indispensable that I should go down and see where the two great head-branches join. Then go round outside and south about all the springs, so as to be sure no one else will come and 'cut me out' by finding sources south of mine. This may enable me to visit the rock excavations and the copper-mines of Katanga. If we could go straight where we wish, the work would soon be done; but we have to go where it is safe, and where cowardly attendants will not be frightened out of their small wits and smaller sense of duty. We have to make friends with one tribe, in order to venture to another. In this region of dense forests scarcely three villages own the same headman, or know each other. I have a seriously long work before me; but hope that the kind Providence which has helped thus far may aid me through.

"In contemplating my work it is impossible not to think of poor Speke. When he discovered the Victoria Nyanza, he at once concluded that therein lay the sources of the River of Egypt. Ptolemy's small lake 'Coloe' is a more correct view of Okara than that given by Speke and Grant. Three lakes were run by Speke into one huge Victoria Nyanza. Unless the most intelligent Suaheli, who spent many years on the east of this lake, are grievously mistaken, it contains but little water, and the river that comes out is less than

half the size of the Shiré out of Nyassa ; and, at any rate, though it could be called a source, the springs and fountains of the Nile are unquestionably from 500 to 700 miles further up the Great Valley. If I say what I think, others will take offence : I feel in a difficulty, and would fain not hurt the feelings of any one.

"I have lost nearly all my teeth, and am fast drifting into second childhood ; this is what the sources have done for me. A Dutch lady, of whom I know nothing but from scraps in the newspapers, moves my sympathy more than any other. By wise foresight in providing a steamer, and nobly pushing on up the river, in spite of the severest domestic affliction—the loss of her two aunts by fever—she still tried to go south-west, and showed as much pluck as if she had been a descendant of Van Tromp. We great he-donkeys say, 'Exploration did not become her sex.' Well, considering that more than 1600 years have elapsed since the Nile fountains were formerly visited, and emperors, kings—all the great men of antiquity—longed to know where the great river rose, exploration does not seem to have become the other sex either. She came further up than the two centurions sent by Nero Caesar.

"The Manyuema country is in many parts densely peopled by a rather degraded race. The Suaheli firmly believe them to be cannibals, and tell tales of their purchasing dead slaves. The different villages have no political cohesion, and vengeance has been taken sometimes by Suaheli Arabs for supposed acts of murder and cannibalism committed on their attendants. If asked, the Manyuema laugh, and, should they take the inquirer to be credulous, say, 'Yes, we eat people,' and laughingly go into details. But intelligent men among them speak seriously, and point away about north-west to the country of the real men-eaters, which may be that of Du Chaillu's Fans. A black stuff smeared on the cheeks is a sign of mourning. One of my attendants, who believes everything, was told that it was animal charcoal, made of the bones of relatives they had eaten ; and when he appeared shocked, proceeded, in their usual peculiar way, to show him the skull of a recent victim. He pointed it out to me in triumph. It was the skull of a gorilla, here called soko, and this, with serpents, they do eat. The soko, or gorilla, is abundant. His cry, or mew, may be heard any night in the gigantic forests here. It is not very terrible : it is near to what I remember of the call of a peacock, or tom-cat on the top of a London house, but not so vicious in tones as he sometimes puts. Food is very abundant. *Holcus sorghum*, maize, sweet-potatoes, and cassava, yield farinaceous diet ; ground-nuts, palm-oil, palms, and another oil-yielding tree, supply fatty constituents ; sugar-cane,

bananas, and plantains, dainties. Goats, sheep, and fowls in the villages, and elephants, buffaloes, antelopes swarming in the forests, afford plenty of nitrogenous matter. Nets are made strong enough to hold lions, and sokos are deceived by bunches of bananas placed in their way and speared. If the Manynema are cannibals they are so without reasonable cause. For the present I place them alongside the people who have no knowledge of fire—or of a Supreme Being—or of language, but have tails. I shall look for evidence before I believe them to be very horrible. They build square houses, the walls entirely of clay; and the ladies plait their abundant hair into straw-bonnet shape. The brim comes out about 4 inches, and protects their eyes by its shade. They will file their teeth to points—the hussies!

"May, 1870.—I offered a handsome present to any one who would show me human flesh cooked or eaten, but in vain. The native Arabs, or Suaheli, pretended to have seen so much cannibalism, I expected to witness a little. At last a human finger, wrapped in a leaf, was brought, probably a charm taken from a man who was killed in revenge. One who had lived long among them told me that similar small portions were all he ever saw, and the medical profession use them. The doctors seem to have caused the Manyuema, or, as Suaheli say, Manyema, to be called cannibals. If I had believed one-tenth part of the horrible tales the traders and adjacent tribes told me, I might not have ventured to come among them. Fortunately my mother never frightened me in infancy with 'Bogie,' so I am not subject to bogiephobia, in which the patient believes everything horrible, if only it is imputed to the possessor of a black skin. A worse obstacle than Manyema cannibalism—the rainy season—has detained me some months. The vegetation is exceedingly rank. Through the grass of the valleys—if grass it can be called—which is more than half-an-inch in diameter in the stalk, and 10 or 12 feet high, nothing but elephants can walk. Broad belts of forest stand between each district. Into these the vertical sun sends but a few rays. The rain-water stands in holes made by elephants' feet, and the dead leaves decay on the damp soil, and make the water of the numerous rills and rivulets of the colour of a strong infusion of tea. The mud, or mire (Scotticè, 'glaur') is awful. Bad water, perpetual wettings, brought on choleraic symptoms, and great emaciation. I came to a stand, till the rains cease, with the heads of a Suaheli horde, which the news of cheap ivory brought from Ujiji. After us, they are as kind as I could wish. Rest, boiling all the water I use, and a new potato have restored me; but I see that, as soon as I find out where the

Lualaba goes into the Lower Tanganyika, I must retire. I must leave the excavations to some one else. Up the back, or southern, slope of the watershed no river can run; so no one can find sources of the Nile south of mine; but I would put it modestly. I may be mistaken, as others have been, though at present I cannot conceive in what.

"My experience with the pupils from Nassick Schools makes me venture the hint that teaching them to work on board a man-of-war anchored in a healthy spot, as is done, by Lord Shaftesbury's suggestion, with the outcasts of London, would be a great improvement on Mr. Price's plan. If made sailors of, and forced to work, they would be a benefit to the country. Taught to wash, cook, and mend and make their own clothes, and the numerous jobs sailors can do, they would be respected. If the sons of any English gentleman were treated as these poor unfortunates are, they would inevitably be spoiled for life. We have all to be taught that work is our lot—a blessing and not a curse. To them work is an unmitigated evil. I look with great anxiety to the freedmen in America, but indulge half a hope that they have more manhood than mine. The way in which the United States Christian Commission carried on their gigantic work for the army may be repeated for the recent slaves. To elevate 4,000,000 is a superhuman task; but the Lord of all seems to be putting forth His power to gather all into His kingdom.

"I got a small box from Zanzibar, probably from Dr. Kirk, with some wine and preserves, a few 'Saturday Reviews' and 'Punches,' but not a scrap of a letter. I gleaned all I could from advertisements, &c. I fear that my letters are kept by an influential man at Unyanyembe or Garaganza, called the 'Governor' Syde bin Salem Buraschid by name, for a certain long box was left with him having medicines, two English guns, letters, and despatches therein. I sent for it twice and received no answer, and I am uncharitable enough to think that he wishes to fall heir to my guns. I have no letters later than 1866, and none from you, but they may be at Unyanyembe. My attendants are too cowardly to go anywhere without me to shelter them, and if I had gone I should have been thrown into the rainy season at Ujiji instead of in Manyema. I was much pleased to see by a 'Saturday Review' that Miss Frere had turned author and had wisely chosen a path in literature but little trodden. Her sister doing the tropical scenery shows that she had been in India too: I wish she had been in Africa, for my drawing is like what little boys do on walls, and I have no inducement to try and do better; for even photographs, showing good foreheads, were by the wood engravers made into the low conventional negro

shape. It seemed that they could not draw anything but the West Coast type, while here very many have finely-shaped heads, straight or aquiline thin noses and thin lips, magnificent forms, with small feet and hands, graceful limbs; and barn-door mouths, prognathous jaws and lark-heels are never seen. Your name on the list of stewards at the Literary Fund dinner told me that you were in England; but this was addressed before I saw it. My kindest salutations to Lady Frere and her family. Although this is grievously prolix, and the climate has told on the ink, I shall add little with the latest information.

"Affectionately,

(Signed) "DAVID LIVINGSTONE."

"MY DEAR SIR BARTLE,— "Lake Bangweolo, South Central Africa.

"The route I chose to take up the thread of my exploration where it was broken by the Banian slaves has proved more difficult and time-consuming than I anticipated. An Arab war at Unyanyembe led me to go due south, so as to avoid bands of marauders who were incited to lawlessness by the disturbed state of the country. Four parties of traders had been broken up by them before we started, but we got away safely, and turning west soon came to Tanganyika. The eastern shore is very mountainous, and the rocks of the southern half, chiefly mica-schist and gneiss, are lifted up on edge, as the leaves of a book when turned up on its back and slightly opened. It seems as if a wedge, the breadth of the Lake, had been thrust up from below where the water now stands, and crushed the strata up and away as they now appear. The marching was excessively severe, and it produced many cases of subcutaneous inflammation in the limbs—'black' rose, or erysipelas; and when I mildly proposed surgically to relieve the tension, the idea was too horrible; but they willingly carried the helpless. Not a shower had fallen, and the grass, mostly burned off, left a surface covered with black ashes, from which the heat radiated as out of a furnace, or say an oven. Yet out of this hard, hot surface the flowers, generally without leaves, persisted in coming. A species of ginger, with its large purple and yellow blossoms, was the most conspicuous in obeying some law like that of the Medes and Persians. When we came to the south end of Tanganyika we suddenly mounted 4000 feet up to the highland region, Urungu, and into the strength of the rainy season there, with everything green, and every place sloppy and slippery. I passed through this region before, and besides almost proving fatal at first, when the

rains ceased, and circumstances compelled my remaining for three months and a half at an altitude of 4700 feet above the sea, it proved eminently restorative. Some folks require a good deal of killing, and then again a mere fleabite gives the quietus. Three of the Baurungu chiefs had died during my absence, one—Kasonso—a great friend of mine, for he lent me his son to guide me to Liemba, as the lower portion of Tanganyika is called, and sent a large quantity of food after us, with no hope of reward. One meets with good fellows everywhere, and some atrociously bad ones; but I think that we African travellers have of late years got too much into the novel-writer's habit of turning up the whites of our eyes, and holding up our paws, as pious people are all thought to do, whenever we meet with any trait not exactly 'Europe fashion.' The elections had turned the population all topsy-turvy. They elect a sister's son or a brother, because the heir-apparent may not be the heir real! The old stockades had all been abandoned, and new ones built. Forest and virgin land had to be cultivated, and the reclaimed acreage was necessarily small. Food was very scarce, and hunger helped to strengthen our old orthodox faith that chief magistrates ought on no account to be elected. Never saw such cloudy weather; no astronomical observations, except a few snap latitudes, could be made for over three months; and it rained night and day as if it would never tire. Former positions carefully observed were now of no use, and the people showed a perverse ingenuity in leading us west. When I insisted on following the compass, they had me completely in their power, 'No food in that line for ten days;' and then I had to think of the empty stomachs of my poor fellows, who were collecting mushrooms—very good, no doubt, as mushroom-ketchup with a joint, but no more fattening alone than the east wind which wild asses snuff up. They brought us down to the back or north side of Bangweolo, and however much I longed and watched for a lunar distance none could be obtained. Then the rivulets spread out in the flat country, as they came near the lake, so as to be impassable. Many long return marches, for days together, had to be made to extricate ourselves from the meshes whose threads were from two to three miles broad. The poor fellows carried me through the waters, though it would have been more agreeable to me to wade, as I did when I had unwilling libertos. My thighs became sore from resting all my weight by the hour on their shoulders. They have hitherto done remarkably well. The highest praise I could bestow would be that they equal the Makololo; but they are cowards, and the system of their education has left out truthfulness as one of the virtues. I always

remember the services of the brave, kind-hearted, sensible, truthful, and albeit rather wicked Makololo, with a warm glow in my heart. The rivulets flowing into this lake often spread out into estuaries, and make Bangweolo look as if she had a string of oblong pearls round her neck. At other seasons this may be different. The country adjacent is all flat forest; an hour's march in this brings you to a rivulet flowing in a meadow, with one or two hundred yards of weeping earthen sponge on each side; a stream runs along the centre, or winds from side to side of the slightly depressed valley. Crossing this, and ascending a few feet by a gentle slope, you enter forest again, or plod through great patches of brackens and other ferns into forest again. The rivulets are legion; none but an eye-witness could believe the prodigious amount of water in the country, all flowing into Bangweolo. When its discovery was announced at the coast, some one wrote a description of it, and stated that it is, like Nyassa, Tanganyika and the Albert Nyanza, overhung by high mountain slopes, which open out into bays or valleys, or leave great plains, &c. The lake and country adjacent are about 4000 feet above the sea, but the only slopes are those of ant-hills, which can scarcely be called high, unless thought of as perched on the top of the 4000 feet altitude. The country, as far as the eye can reach, is remarkable only for extreme flatness, the slope being generally not more than from the Isle of Dogs down to the level of the Thames. The description was possibly penned from Arab palavers, and the fascination of describing the unknown had better be resisted, or left to the poets.

" The Chambeze and other rivers flow into its north-eastern horn through great spongy bugas or prairies. The Portuguese crossed the Chambeze, as I did, high up, where it is small: they were real Portuguese, and not black men with Portuguese names, so they are the first European discoverers of this river in modern times. The similarity of name to the Zambesi led them to consider it a branch of that river, and, misled by a map saying 'Zambesi (eastern branch)', I stupidly made my first crossing as fruitless as theirs. It cost me full twenty-two months to eliminate this error, and I was less excusable than they; for I ought to have known and remembered that while Chambezi is the true native name of the northern river, Zambesi is not the native name of the southern river at all. We followed the Portuguese corruption of the name, rather than introduce confusion as to a name possessing a rather melancholy interest from the survey and deaths of the officers of Commodore Owen on the river that flows past Tette, Senna, Shupanga, and into the sea by Luabo and Kongone. The name by which the natives all know it,

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and speak of it to each other, is Dombazi. When they speak to Portuguese or English, they call it Zambesi or Zambeze. Above the Victoria Falls its name is Liambai. We followed the same course with the lake, whose rather pretty name is Nyanza ia Nyinyesi, or Lake of Stars, because the Portuguese corruption Nyassa was known in geography, and it was rather dumbfounding to find it printed as a profoundly learned thing 'Nyassi or the Sea,'—Nyassi meaning a species of very long grass, and nothing else. I gained the first rays of light about Chambeze, not from my own acuteness, but from the rather bantering remarks of the Cazembe, who was lately routed and slain by a party of Banyamwezi, whose countryman, Funga Funga, he murdered. Certain Arab traders made great preparations for his downfall, and, after going several miles up the boundary river Kalungwesi, thought better of it, told their slaves that the river was too deep, and went away to trade in Rua; the Banyamwezi brought the head of Cazembe to the Arabs, who are immensely elated in consequence, and, after their manner, give circumstantial details of their prowess in the fight, which would be quite interesting, did we not know that they contained not a word of truth. On telling this Cazembe that I wished to visit Bangweolo, he said, 'One piece of water is just like another: you have seen water in Moero and Luapula, the very water that was in Chambeze and Bangweolo; but as your chief ordered you to see it all, by all means go, after I have procured good guides and food for you,' &c. I was not sure that this was not royal chaff, till I stood on the islet Mpabala, and had an intelligent islander, slowly moving his hand round 183° of sea horizon, and saying, 'That is Chambeze, forming Bangweolo, and passing round that western headland to change its name into Luapula.' It was then that the discovery of this line of drainage was made; but some may feel that our allies the Portuguese, being the first to cross the river, deserve all the credit. If so, I shall not quarrel over the matter; but Culpepper and astrology preceded Herschel and Lockyer, men whose names I am not worthy to mention. It suits me better to laugh over the great discoverer of Inner Africa, who, after the undoubted discovery of the Chambeze, made it run east instead of west, and toddle away some 4000 feet uphill; and then challenged me in a learned periodical to argue the point, whether Chambeze was or was not the 'New Zambesi.'

"The Lake people are of the Bisa stock, and have long been eager slave-traders. Large caravans of Babisa, Bazio, and Banyamwezi, frequently went to the coast, and the effect of the enterprise has, in the first two tribes, been depopulation of their own countries. Where no foreign slave-trade has existed the people live in peace,

and follow peaceful cultivation of the soil. The frequent visits of Arab slavers are followed by chronic warfare and mental soreness against all strangers—this seems to be the invariable effect of their system; but in Central Africa, generally, war is rare and women have great influence. When men speak of the tribes being always in a state of chronic warfare, they refer, perhaps unwittingly, to people within easy reach of the coast, who have had many visits from slave-traders. In this region a man, called Motoka, took to marauding on his own account. He inspired terror, and many yielded to him without resistance. He built a line of huts completely round a stockade; I saw and battled two months in vain. The blood relations of the besieged chiefs then assembled, and coming suddenly on Motoka, caused an utter panic and rout, and finished his marauding, though he himself escaped: the news of what guns can do, and the fate of Cazembe, inspired as much fear of us as the most ardent anthropologist could desire. In many places the entire people fled from us, and we got nothing in the villages but damless chickens; then when we did get a guide, he was sure to run away: this, with the impossibility of making astronomical observations, and cold wet forest gloom, made our marches unpleasant. These, I suppose, are the Elephantophagi, the Lotophagi, the Ichthyophagi, into which ancient anthropologists divided the people. Instead of naming our tribes after their eating—as ostrich, elephant, fish, or lotus eaters—we, modern anthropoi, would divide the nations according to their drinks—as the Scotch: the whisky fishoid fuddlers; the gin and stout guzzlers; the roaring Potheeners; the vin ordinaire bibbers: the Lager Bier swillers; and a far-off outlying tribe of the “Sherry Cobbler” and “Brandy Cock-tail” persuasion. Fish are abundant, elephants and buffaloes very numerous, and two species of lotus, or sacred lily, grow even on the plains, which are flooded only annually; the only drink in use is the everlasting Pombe, which, instead of strengthening the stomach, requires a very strong stomach to master it, and the taste is anything but delicious. It will not drive champagne out of the market in our day.

“ P.S.—November 27, 1870.—I have not a morsel of paper left, so I take a leaf out of my cheque-book to give you the latest information, and materials to correct some points mentioned in the letter.

“ West of this Lualaba, the central line of drainage of the Great Nile Valley, there are two large rivers, each having the same native name Lualaba. These two unite and form a large lake, which I am fain to call Lake Lincoln. Looking back from this

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lake to the Sources on the watershed, a remarkable mound gives out four fountains not more than 10 miles apart. Two of these on the northern side form large rivers, which again form Lake Lincoln, and then the united stream coming out thence flows, I suppose, into the western arm of the Nile. I have presumed to give your name to one of the fountains and a river by anticipation, for if I have any good fortune at all I shall reach them ere this reaches you. Of the two fountains on the south side of the mound, one is so large a man cannot be seen on the other side. I call it after good Lord Palmerston. It is the source of the Liambai or Leeambye—the Upper Zambezi; the last fountain gives rise to the Lueng<sup>b</sup>, which, far down before it falls into the Zambezi, is named Kasue. These fountains are probably the ‘unfathomable fountains of the Nile,’ mentioned to Herodotus by the Secretary of Minerva, in the City of Sais, from which ‘half the water flowed northward to Egypt, the other half southward into Inner Ethiopia.’ I heard of this remarkable spot—which, if in Armenia, would be the locality nearly of the Garden of Eden—from the natives, 200 miles on the south-west; again on the south-east and east, 150 miles off; then on the north-east, 180 miles distant; and here on the N.N.E. many intelligent Arabs who have visited it, and had their wonder excited as much as that of the natives, give substantially the same account. The watershed from which the fountains of the Nile do unquestionably arise, and on which stand Ptolemy’s Mountains of the Moon, is in length between 700 and 800 miles from west to east; the water collects into three lines of drainage. The Tanganyika, whose majestic flow I marked by miles and miles of conerva, and other aquatic vegetation, for three months during my illness at Ujiji, is, with the Lower Tanganyika discovered by Baker, a riverine lake from 20 to 30 miles broad. This Lualaba is another lacustrine river from two to six miles or more broad. The western line of drainage is equally large. Ptolemy has but two of these headwaters, but he probably got information from his predecessors, who inquired of men who had visited this very region, and mistakes were natural in oral information. Speke’s great mistake was the pursuit of a foregone conclusion. When he discovered the Victoria Nyanza he at once leaped to the conclusion that therein lay the sources; but subsequently, as soon as he and Grant looked to the Nyanza, they turned their backs on the Nile fountains. Had they doubted the correctness of the conclusion, they would have come west into the trough of the great valley, and found these mighty streams not 80 or 90 yards, as their White Nile, but from 4000 to 8000 yards and always deep.

"Captain Singleton may have come to the southern end of Tanganika, passed by the north end of Moero, and there crossed this Lualaba, then gone west by Katanga, and come abreast of the Congo Lake, yet undiscovered. The elephants' tusks are now eagerly collected from the interminable forests on Manyema, where they have lain till often half-rotten. I saw the same thing at Lake Ngami. Defoe may have got his story from the supercargo. He began to understand the gunner's charts very well: this could not have been the captain. Trying to magnify the difficulties, he speaks of deserts where none exist. He could scarcely have come through this region without being plagued by the grass, and water is so abundant none is ever carried by travellers. No tradition exists of any white men coming through. The Portuguese are known as '*they of the donkey*', as they had one with them.

"I have now a sore longing to retire. No letters since the date 1866 have reached me. A letter from the Under-Secretary in the Foreign Office forbids me having any claim, no matter what services I may render. This worried me; and it is not without care that I strive to make a complete work of the sources. I feel in a strait: duty draws me towards my family, and duty draws me to finish the work undertaken.

"DAVID LIVINGSTONE."

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## 2.—*To Major-General Sir H. C. RAWLINSON, K.C.B., ETC.*

"MY DEAR SIR HENRY,—

"South Central Africa, 1873.

"I have felt, ever since I left Unyanyembe on this my concluding trip, that I expressed very inadequately the gratitude that welled up in my heart to you and all the promoters of the 'Search and Relief Expedition'; but I was so overjoyed by Mr. Stanley promptly procuring fifty-six free men and what additional goods I needed, to finish all I proposed to do, that I was more like a boy going home from school than the staid, toothless, old fogie which 'the Sources' have made me. My expedition was carefully arranged, with all the experience of many long years of African travel; and the uselessness of the Indians and desertion of the Johanna men did not actually detain me an hour from my work, for I got the country people easily to carry from village to village, as far as Manyuema. The Zanzibar Arabs, who were not members of a slaving coterie upheld by Banian money, were all remarkably kind; but I sent, as traders constantly do, a lot of goods to be placed in dépôt at Ujiji; the carriers, as usual, brought them on

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to Unyanyembe in safety, and there Syde bin Salem, the Governor, gratuitously placed the caravan in charge of his confidential slave Selim, who, when near Ujiji, stopped it ten days, while he plundered the stores, and went off to buy ivory for his master in Karagwe. These goods were amply sufficient to enable me to finish all work I had undertaken to do, without any of that trouble and anxiety which I greatly regret having since caused. I feel really extremely grateful for the kind interest manifested by so many, but no one who knows me or has a faint idea of the devotedness with which I endeavoured to make a *feasible* finish up of the old problem before I retired, will suspect me of a desire to make a fuss about myself. No evidence of this first act of plunder was to be allowed to go to the coast, and the robbery having been perpetrated, as all acknowledge, by the direct arrangement of the Governor, the head of the slaving coterie or ring inland, and Ludha Damje, the great money-lender and head of the ring at Zanzibar, having the ear of those in authority, managed effectually to keep me out of sight. I wish it to be explicitly understood that I twice sent off copies of all my astronomical observations, with sketch-maps; and, as often as opportunities presented themselves, pretty full consecutive accounts of all I had done, for the Foreign Office and for you (Royal Geographical Society); but, except a letter secreted on the person of a buffalo driver, 30th May, 1867, none were forwarded. A letter from near Bangwéolo was taken by an Arab, not a member of the ring, and the three head-men of the caravan being slain in the way down, the survivors took it on to Zanzibar in safety. It is but lately that I have been able to infer that a letter which succeeded the Bangwéolo one, about December, 1868, never reached its destination, for I find that you had been bamboozled by Arab palaver about the upper end of Tanganyika, instead of my statement in letter that, having followed Luapula down through all Lake Moero, I saw the vast rent in the lofty black mountains of Rua (not Ruiva Riweva [?], please), by which Lualaba finds an exit, and I went a three-days' journey round the north end of these Rua Mountains, and saw Lualaba emerge and flow away to the north-west. That sight took off all interest in Tanganyika as a source of the Nile; but I had the opinion that it had an outlet, because the water of shut-in bays, with a river at the end, is decidedly brackish, while out in the stream it is perfectly sweet, though rivers, as the Malagarazi and others, from whose banks great quantities of salt are daily excavated, have been flowing in for ages. Like all large rivers in this country, which have north and south reaches, it wears away its eastern bank. Ujiji is a full mile from the spot—now deep

water—where it stood in the memory of persons still living, and palm-oil palms stand fifty yards out from the bank, where, when young, they could not have lived; and so of other trees whose habitat is dry land, they now stand dead, like the palms, where it is never now dry; and I watched, when in great weakness, the steady flow northwards at Ujiji, in 1869, by the rivers Luiche, Malagarazi, and others having discoloured water, being at once bent away in that direction, as also by large masses of *confervæ* and other aquatic vegetation. But Tanganyika has no interest as regards ‘the sources;’ its springs are too far down the great valley. It was gratifying to find that, though my letters disappeared, Keith Johnston *secundus*, as he ought to be called, had, with the true geographical acumen of my lamented friend Keith Johnston *primus*, conjectured that the drainage went north-west, as I found it, and to the Congo, as I often feared. My longitude by reckoning was two degrees wrong, and no wonder—the dense, dark forests of Manyuema would puzzle anyone but a soko or gorilla. By a patent process I squeezed a longitude out of a dead chronometer! and as the same process agreed pretty closely with Speke’s north end of Tanganyika, I set the Lualaba in  $4^{\circ} 9' S.$ , as flowing in  $27^{\circ} E.$  nearly. Lat.  $3^{\circ} 36'$  was my furthest down, but my last instrumental observation was  $4^{\circ} 9' S.$  I had the good fortune, unwittingly, to verify the famous hypothesis of my late much-loved friend Sir Roderick, and I have since discovered an additional feature to that which he sagaciously conjectured, in that while the continent has two subtending ridges, the enclosed space is not a hollow, but a series of miniature formations, exactly like the main continental one.

“I cannot now describe them, but each lake and river-system has lofty subtending ridges of the old crystalline rocks exactly alike, and sometimes as high as those that flank the continent. A knowledge of these is conclusive against Lualaba being Congo, but I am not ‘cock sure’ (though all the rivers right from Congo’s eastern flanking ridge flow into the great valley) till I meet with Baker, and for that meeting I do most intensely long. I am tired beyond measure; it was only the plaguey John Bull tenacity that bore me on, plundered by the head of the slaving coterie inland; then another lot of goods was delivered to Tháni bin Abdulla, a boon friend of the Governor, and it disappeared altogether; then a third lot of some 500 was sent with slaves instead of men, and, except 4*l.*’s worth, was sold off at Ujiji by Shereef for slaves and ivory, and (4*l.*) the exchange of good for unsaleable articles sent, and obviously intended to force me back, were reported to the Arch ( ?)

Ludha, and without a hint from the nominal recipient, was reported as 'all Dr. Livingstone's wants supplied,' and Shereef called active and dis[?] interested. It is wearisome to recount all the villainy. The fourth lot of some 300*l.* lay with slaves and the inevitable Ludha's agent Masudi, three and a-half months at Bagamoio: not a hint of these losses went to the Consulate; even Stanley was kept in the dark, except that a lot of slaves had been sent to bring me back, and every effort was made at Unyanyembe to prevent him going to my aid. In extreme anxiety to reach me he tried to pass the so-called rebel Mirambo with the Arab army, but Governor cut and run; this difficulty was promptly reported at the coast and at home, and led to the Search and Relief Expedition; but no mention was made of me, though the Governor acknowledged the receipt of two despatches written as soon as I reached Ujiji. Shereef was living at the Governor's table, and Stanley learned only at the Malagarazi from a native that I was close by at Ujiji. I gave up all hopes of aid from Zanzibar, and resolved to work my way down to Baker for help, when Stanley came on the scene as my good Samaritan. I would willingly have died rather than be beaten outright by intrigue; the men who have profited by my losses are all rich except Shereef and the slaves. It is proposed now to punish the latter only. I think the rich ought to refund, as was done in the case of the Baron von der Decken. Ludha and Nassur are said to be dead, but their estates, and even debts, could amply repay the money stolen; but it seems that I alone am to blame. When my letters were destroyed, my salary was stopped.

" My case was 'anomalous,' said Lord Russell, but he gave '800*l.*' a year to my subordinate, Dr. Meller, for the 'anomalous' position of being Consul in Madagascar without any consular duties, but all will come right in the good time coming.

" Yours, &c.,

" DAVID LIVINGSTONE.

" The watershed runs from east to west, an elevated mass about 4° of latitude broad, across two-thirds of the continent, and gives sources to Nyassa and Shiré, to Loangwé, to Zambézi, to Congo, and to Nile."

" MY DEAR SIR HENRY,

" South Central Africa.

. . . . " I was a little sorry that by a strong dose of the cheap nostrum called good advice, the gallant athletes\* chose to wait for

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\* In allusion to the Livingstone Search Expedition of 1872.

the cessation of the rains, for by remaining on a most unhealthy and an awfully stinking island all their good intentions oozed out at their finger ends, and I had no opportunity of bringing to their notice the very important service of exploring the Lake system of the Victoria Nyanza. I certainly did not need them for my work; they would have 'resigned'—a naval phrase for 'going on strike'—before they waded through half the water which I have been obliged to ford around Lake Bangweolo, and unanimously voted me to be a beast, deserving death, or, as the Articles of War say, some worse punishment. I don't know who gave the good advice, but Stanley went off at the beginning of the heavy rains, and, after knowing their worst, coolly elected to go through all the Masika again in order to hasten up the men and goods I so much needed. I left in the middle of the Masika, too, for the reason that I had my English stock of robust health with which to battle against the pelting rains. I have had another spell of Masika on the watershed, the worst I ever endured, for the cold north-west stratum of air, thick with clouds, lay like a wet blanket on all that upland forest land. For three months I could not get an astronomical observation, except a few snap latitudes. I was led down to the back or northern side of Bangweolo, and near to its western end. Had to plod away to the south-east through riverine meshes, each thread from half a mile to three miles broad, deep, and encumbered with great masses of aquatic vegetation. Branches come out of the larger streams and flow over endless slightly-depressed valleys, among four or five species of rushes—among three species of lotus or sacred lily plants, papyrus plants, and many other plants that grow only in water, very much as other rivers near the coast flow in branches among mud and mangroves. Some of these deltas of aquatic vegetation are from forty to fifty miles long, and too broad to be seen over, but only grassy seas, with ant-hill islands, having trees at great distances from each other. No one but an eye-witness could imagine the vast amount of water in the country. Six rivers, of Cam or Isis size, flow in from the south; they rise on the edge of the watershed, or not so far off, that overlooks the deep valley of the Loangwa of Zumbo. The shores of the lake, and for days out, are remarkable only for extreme flatness. When I visited it in the dry season there was generally no more slope to it than there is from the Isle of Dogs down to the Thames; now it is nearly impossible to tell where land ends and lake begins. Some one, overcome by the fascination of describing the unknown, said that it was, like Nyassa, Tanganyika, or the Albert Nyanza, overhung by high mountain slopes that open out into bays and valleys. The only slopes I saw were

those of ant-hills, which may be called high if thought of as perched on the general altitude of almost 4000 feet. This seems to be the head of one main line of drainage of the Nile; but I am not positive till I meet with Baker, and for that meeting I do most intensely long. I was not aware till Mr. Stanley came that a letter that succeeded one of 1868, from near Bangweolo, had been destroyed; the three head-men of the caravan that carried the Bangweolo letter were slain by a tribe in the way, but the survivor carried it on safely to Zanzibar. Following Luapula down through Moero, I saw the vast rent in the lofty black mountains of Rua through which the Lualaba finds its exit, and I went three days' journey round the end of these Rua mountains and saw Lualaba coming out of the same fissure and flowing away to the north-west. The drainage clearly did not go into Tanganyika, and that lake, though it probably has an outlet, lost all its interest to me as a source of the river of Egypt. I wrote to this effect in December, 1868, but the letter never went beyond the Governor of Unyanyembe. I was amused to find that geographers had been bamboozled most unmercifully by the Arab palaver that the Nile flowed out of Tanganyika's northern end. That it was distinctly brackish in shut-in bays and perfectly sweet out in the main stream, though rivers from whose banks, as the Malagarazi, enormous quantities of salt are daily taken, have been flowing in for ages; that, like all great rivers in this country having north and south reaches, it was fast wearing away its eastern banks (the village of Ujiji, for instance, stands a full mile east of where it stood in the now deep water in the memory of persons still living); that several palm-oil palms now stand out fifty yards from the Ujiji village shore, where they could not have grown had water been there when they were young, and many other land-trees now stand in the water in the same circumstances:—these reasons made me form an opinion that it had an outlet, and I unwisely mentioned that opinion in a private letter. We did not find an outlet in the north, though an Arab asserted, within one day's sail of the Lusize, that positively Tanganyika water ran out by it and not in. He was not ashamed when told to look at it.

"Knowing where the main drainage went, I worked at it, though without men and means, and then got Banian slaves—the worst of all slaves—and about *4l.* out of *500l.* or *600l.* worth of goods. It was gratifying to see incidentally in some paper that Keith Johnston, who ought to be called '*Secundus*,' for he has the genuine geographical acumen of Keith Johnston '*Primus*,' had, without knowing the rent in the Rua (not Ruwa or Uruwa) Mountains, reasoned out the drainage from Bangweolo as going north-west, as

I found it, and, as I often feared, went thence to the Congo. My reckoning made it flowing  $24^{\circ}$  to  $25^{\circ}$  E.; and no wonder, the dense, dark forests of Manyema would puzzle anything except a gorilla or soko. By a patent process I succeeded in squeezing a longitude out of a dead chronometer, and that made it flow in  $27^{\circ}$  nearly. The same process made the north end of Tanganyika nearly the same as Speke's. It is interesting to find an offer made to the Government to supersede me by running up to the end of Tanganyika, and to call me out of Manyema, where Arab palaver said I was 'living like an Arab.' My discovery shows that I alone knew what I was about; and the other plan, than a search or relief expedition, about which you did not enquire, would have shown the unwise of believing Arabs, who are the least reliable of all informants. I wish it to be especially understood that I twice sent copies of all my astronomical observations, with sketch-maps, and, as opportunities presented themselves, pretty full consecutive accounts of all my work, for the Foreign Office and you; but not a letter was suffered to pass the members of a slaving coterie, or ring, of which Ludha Damji was the head and chief money-lender at Zanzibar, and Syde bin Salem, the Governor of Unyanyembe, was the chief inland. One letter alone escaped. It went off in company with a large packet of observations, despatches, and letters; but in the hands of a buffalo-driver, who wisely secreted it on his person, in the belief that on its production his wages depended. All else were destroyed, though I explained to the Governor that the packet contained despatches which his Sultan desired to be sent on with great care. Evidence that Syde bin Salem had, by his slave Salim, plundered my caravan was not to be allowed to go to the coast, and so of the plundering by Thani bin Abdullah, and Shereef, and they were successful; and because these wretches destroyed my correspondence, Mr. Murray, of the Foreign Office, stopped my salary—a very un-English deed, to be laid at the door of the English Government. The slavers did their utmost to prevent Stanley going to aid me; and when he went with their army, to try and get past the rebel Mirambo, Governor cut and ran. This was promptly enough reported as 'Stanley in a difficulty,' in hopes of getting him recalled, and it led to the Search and Relief Expedition. No prompt report was made of my presence at Ujiji, though the Governor acknowledged that he had received two despatches from me there, written immediately after my arrival. Stanley learned of my presence only at the Malagarazi, close to Ujiji. Not only was information burked on its way to you, by notes put into Arab packets being abstracted, but they gave only what was convenient

to H.M.'s Vice-Consul; and when the two heads of the ring were entrusted with stores and men for me, the result might have been anticipated. I think that the plunderers, or their estates, ought to refund, as was done in the case of Baron von der Decken; but this may not be agreeable to their friends. Meanwhile we shall see.

"Yours, &c.,

"DAVID LIVINGSTONE."

3.—*To (the late) SIR RODERICK I. MURCHISON, Bart.\**

"MY DEAR SIR RODERICK,

"Manyema, or Cannibal Country,  
say 180 miles n.w. of Ujiji,  
April—July, 1870.

"As soon as I was able to march (July, 1869) I struck away n.w. from a point 60 miles up Tanganyika into the country of the Manyema, or, as Suaheli say, Manyema, who are reputed to be cannibals, and soon found that I was in the large bend made by the great lake-river Lualaba. I saw it after it left Lake Moero, going n.n.w., to form itself into a lacustrine river, at first some 12 miles broad, with several inhabited islands in it, and then holding a breadth of from two to six miles or more; when, having accomplished its westing, it turns away to the north. I made up to a trading party, which had rendered me most important aid in severe illness in Marungu; and two days before reaching the villages of the most intelligent and trustworthy chief in Manyema, called Moenekuss, we met a band of Ujijian traders, carrying 18,000 lbs. weight of ivory, bought in this new field for a mere trifle in copper beads, and the traders had been obliged to employ their slaves to collect the ivory,—and slaves with guns in their hands are often limbs of the evil one. We heard but one side of the story, the slave version, and such as would have appeared in the newspaper if they had one. The Manyema were always in the wrong; wanted to eat them, and always gave occasion for having people, goats, fowls, and grain captured: then masters and men joined in one chorus, 'The Manyema are bad, bad, very bad!' In going west of Moenekuss, I followed the Suamo, a river from 100 to 250 yards broad, and always deep enough to require canoes, to near its confluence, and was then among people who had been maltreated by the slaves. They naturally looked on us as of the same tribe with their persecutors. The Africans are not unreasonable, though smarting under wrongs, if you can fairly make them understand

\* Communicated by Kenneth R. Murchison, Esq.

that you are innocent. The women were particularly outspoken in asserting our identity with the cruel strangers. On calling to one vociferous lady—who gave me the head trader's name—just to look if I were of the same colour, she replied, with a bitter little laugh, ‘Then you must be his father.’ The worst they did to us was to turn out in force with their large spears and wooden shields and show us out of their district. Glad that no collision took place, I returned to Moenekuss, and then with our friends struck away due north—they to buy ivory, and I to reach another part of the bend of the Lualaba and buy a canoe.

“The rains began in November, and as I had in previous years two severe lessons that travelling in an unhealthy country in the wet season is killing work, we went slowly and with great caution. The vegetation is indescribably rank: through the grass—if grass it can be called, which is over half-an-inch in diameter in the stalk, and from 10 to 12 feet high—nothing but elephants can walk. The leaves of this mammoth grass are armed with minute spiculae, which rub disagreeably on the side of the face where the gun is held, and the other hand is made sore by fending it off the other side for hours. These leaves are often loaded with moisture, and as we worm our way along elephants’-walks they wet us to the bone. When one gets a sight of the country it is extremely beautiful. The mountains of light grey granite stand like islands in new red sandstone. Mountain and valley are all clad in a mantle of different shades of green: the valleys are deeply undulating, and in each innumerable dells have to be crossed. There may only be a thread of water at the bottom; but the mud, mire, or Scottieè ‘glaur,’ is terrible. In some cases, the ‘muale’ palm, of which, here and in Madagascar, grass-cloth is made, and called by the name ‘Samba,’ has taken possession of a valley; the leaf-stalks, as thick as a man’s arm, fall off and block up all passage, save by a path made and mixed up by elephants and buffaloes; the slough therein is grievous and deep, and every now and then the traders, with rueful faces, stand panting; the sweat trickles down my face, and I suppose I look as grim as they, when I express a hope that good prices will reward them at the coast for all their toil. Some of the rivers that enter the Lualaba are blocked up with aquatic vegetation, and show that the mother-stream, like Tanganyika, has but a gentle current. This vegetation forms itself into a mat, which covers the whole stream, and is a living vegetable bridge. A species of grass, with its leaves and roots, is the chief felting agent. When the water is shallow, the lotus, or sacred lily, sends its roots to the bottom, and spreads its broad leaves all over the floating bridge, so

as to make believe that it is the supporting agent, but the grass referred to forms the mat. When one treads on it, the foot presses it down a foot or fifteen inches, and that amount of water rises on the leg. At every step you have to lift the foot high enough to place it on the unbent mass in front, and it fatigues like walking on deep snow. Here and there holes appear, which we could not sound with a stick six feet long. They gave the impression that anywhere one might plump into deep water and finish the exploration. It is called 'Tikatika' on Lake Okara, or Victoria Nyanza: here it is named 'Kikinge' and Kintefurtefur. Tanganyika would be covered with it like large spaces of Okara were it not for its current.

"Between each district large belts of the primeval forest still stand. Into these the sun, though vertical, cannot penetrate except by sending down thin pencils of rays into the gloom. The rain-water stands for months in stagnant pools made by elephants' feet, and the dead leaves decay on the damp soil, making the water of the numerous rills and rivulets of the colour of strong tea. One feels himself the veriest pygmy before the gigantic trees; many of their roots, high out of the soil in the path, keep you constantly looking down, and a good shot-gun does no harm to parrots or guinea-fowls on their tops. The climbing-plants, from the size of whipecord to that of a man-of-war's hawser, make the ancient path the only passage. I have heard gorillas—here called Sokos—growl at me within 50 yards, without being able to get a glimpse of them: their call to each other is like that of a tom-cat, and not so loud and far-reaching as that of the peacock. His nest is a poor contrivance, not unlike that of our wild pigeon. Here he sits, even in pelting rain, with his hands and arms over his head. The natives call it his house, and laugh at him being such a fool, as, after building a hut, not to go beneath it for shelter. Bad water and frequent wettings told on us all by choleraic symptoms and emaciation. Meanwhile the news of cheap ivory caused a sort of Californian gold-fever at Ujiji, and soon we were followed by a horde numbering 600 muskets, all eager for ivory: they were going where I wished to go. It was unadvisable to join them; so, fearing that my weakness might by further exposure result in something worse, I followed the fashion in vogue when you were a soldier, and on 7th February last went into winter-quarters. I went back about seven days to a camp formed by the heads of the above-mentioned horde, and found these men as kind and civil as I could wish. Sir Bartle Frere's letter has done me a world of good with the Arabs. I had no medicine but rest; boiling all

the water I used, and a new potato, found among the natives, as restorative, soon set me on my legs again. The rains continued into July, 58 inches; and the mud is so awful, everyone complains of it. Then my attendants—petted liberated slaves—are a greater affliction than all the rest combined: lazy, lying thieves; all unclean, and three murderers.

"Slowly, but surely, has the conviction crept across my mind, that all I can in honesty and modesty claim is the *re*-discovery of the sources of the Nile, which had sunk into oblivion like the circumnavigation of Africa by the Phœnician admiral of one of the Pharaohs, about B.C. 600. Herodotus did not believe him because he said that, in passing round Libya, he had the sun on his right hand. This to us, who have gone round from east to west, stamps his tale as genuine. By placing the sources of the river of Egypt and Mountains of the Moon in 10°-12° S. lat., Ptolemy or his predecessors gave genuine information from men who had visited this very region. The probability of this is very great, because the fountains and mountains stand in his geography where no theorist would have placed them; and also because he makes the head-waters of the Nile collect into two or three large lacustrine waters—Tanganyika and Lualaba, and Lualaba West—extant specimens of those pre-historic lakes and rivers, whose beds are known in the Bechuana country in the south as 'melapo,' and in the north of Africa as 'wadys:' both words meaning the same thing—river-beds where no water ever now flows. Ptolemy's informants must have travelled extensively, or they may have been more clever than I am. Had I left at the end of two years, I could not have given as correct a view as they did; in fact, I could have given little more light on this region than the Portuguese, who, in their three slaving visits to Cazembe, asked only for slaves and ivory, and heard of nothing else. I asked about the waters till I was ashamed, and feared that I should be set down as afflicted with hydrocephalus. I had to feel my way, and every step of the way, and was generally groping in the dark; for who cared where the rivers ran? Forwards, backwards, sideways, I went, in a route which I shall never attempt to put all down; and many a weary post I trod ere I gained a clear idea of the drainage, and, after all, I must only in fairness speak of the *modern* or *re*-discovery of the sources of the Nile. The errors of the ancients were what might be expected in copying oral information; but that of which they seem to have had no idea may be considered mine. The watershed, from which by innumerable rills and rivulets the Nile takes its rise, is about 13 degrees of longitude from west to east: the rose of a garden

watering-can reversed, and the water running in, instead of out, between 700 and 800 miles in diameter, is a not very apt similitude, but the best I can at present think of. Parts are wonderful and enormous sponges, with a series of perennial rills, rising all down the slopes; and I feel a little thankful to Old Nile for so hiding his head as to leave all 'theoretical discoverers' out in the rain. The Mountains of the Moon had better be accepted as those where Ptolemy puts them, and where, on the watershed, I found both fountains and mountains: accept or reject both. Their height, between 6000 and 7000 feet above the sea, is too low for snow to have lain in 12° s., at least since the last glacial epoch. But did Ptolemy, or later writers, propagate the idea of snow? Mounts Kenia and Kilimanjaro are said to be snow-capped; but they are too far from the sources, and never send water to any part of the Nile, and could not have been meant by men who gave the springs so correctly. The somewhat crescentic form of the watershed could scarcely have given rise to the name *Lunæ Montes*, otherwise the Greek geographer would have given the half-moon shape, instead of that of cocked-hats. If we must accept the fountains, we can scarcely reject the mountains, though nowhere did they appear lofty except when coming from the s.s.e., and then I was in the bed of an ante-historic lake sunk deeply below the general level. Much love to Lady Murchison. Lord Palmerston, Daubeny, Whewell, and poor Gordon Cumming,—all gone. I think anxiously of other friends, but no news reaches Manyema.

"Ever very affectionately yours,

(Signed) "DAVID LIVINGSTONE."

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4. To I. B. BRAITHWAITE, Esq.\*

*Extracts from Letters, dated November and December, 1870, and January, 1872.*

"Had I known all the hunger, hardship, toil, and time required, I might have preferred a strait-waistcoat to undertaking the task; but, having taken it in hand, I could not bear to be beaten by it. . . . .

"It is not without anxious care that I have stuck to my work with John Bullish tenacity. The only thing I could feel sure of, in the absence of all letters, save a few three-year-old in 1869, was

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\* Communicated by Mr. Braithwaite.

this, that you and all my friends would approve of my doing well whatever I did. . . . .

"I do not know whether I have a salary or not. In a note to Sir Roderick, now by me, Lord Russell says that he intended to give me 500*l.* a-year, if I settled anywhere. My position, he said, was somewhat anomalous, in not being stationary; but at that very time he gave my subordinate, Dr. Meller, 800*l.* a-year, not for consular duties, for he was to have none in Madagascar, but for scientific research. In that he would have been as I am; but his health could not stand the climate of Madagascar, and he was provided with the Directorship of the Botanic Gardens at Mauritius instead. . . . . Lord Palmerston sent Mr. Hayward, a Queen's Counsel, to ask me how he could aid me, as he was most anxious to be of service to me. Most unaccountably, it never once glanced across my mind that he meant anything for me or for my children, nor did it ever occur to consult my friends till I was out here, and my good friend Lord Palmerston dead. *I thought of my work in Africa, and of that alone,* and asked for the ports of East Africa to be opened to lawful trade. No treaty existed for that, and I did not even once think of asking for some public honour or office to show the Portuguese that, as I knew by his private letters, he (Lord Palmerston) approved of my efforts. . . . .

"On the Zambesi and Shire I lost fully 6000*l.* . . . . .

"I was so jaded in my mind by that last book, that I had not my wits about me. Lord Palmerston would have righted me at once, had I told him.

"The Foreign Office gave 500*l.*, Mr. Young 1000*l.*, the Geographical Society gave 500*l.* I am far beyond the 2000*l.* (thus given), which was to serve for two years. I am *five years out, and on my own resources long ago.*"

"January, 1872.

"I am now anxious on another matter—the plan which I am about to advance of removing one of the English settlements on the West Coast by *voluntary* emigration of the native Christians to a healthy spot on this side of the continent. When I say *English* settlement, I don't mean a settlement of English people, but one of those establishments in the west which have fulfilled their end. The settlements referred to have fully accomplished the ends of their establishment in the total suppression of the slave trade wherever their influence extends. Colonel Ord's valuable Report fully confirms this; the suppression being, as he says, as complete where they are unvisited by men-of-war, as in parts to which these ships habitually resort. . . . . The success of missions in the west is

unquestionable, and the cessation of the slave trade all around the settlements is worth all the expense which has been borne by Government and Missionary Societies. *Let us have these instruments here.* Wherever English missionaries are established, traders are welcomed and protected. We need native Christians to diffuse morality."

Mr. H. M. STANLEY said that during the picknicking voyage to the north end of Tanganyika, which Livingstone and he made together, they had hoped to discover some broad avenue of water along which they might float towards Baker; accordingly they had bright anticipations of freedom from trouble, of meeting Baker at Gondokoro, and giving their *au revoir* to the gentlemen negroes of Africa, for they intended to float down the Nile. But when they came to the north end of the lake they saw the head of the lake environed by mountains lifting themselves, all tree-clad from base to summit, 2500 and 3000 feet above the level of the Tanganyika, with only one broad gorge whereby any affluent might enter the lake; and all their bright anticipations and dreams and hopes vanished, and they had to begin life again and return to Ujiji. On the 14th March, 1872, he parted from Livingstone at Unyanyembe, and Livingstone had then said to him, "If ever you get a chance, my dear Mr. Stanley, tell those people who may be at home wondering and wondering why I do not come home, what you know of me. If there is anything in my letters that requires explanation, do you give the information, and then they will understand why it was I could not return." He thought he had done what the Doctor had requested him to do, at Brighton; but he had hoped that what he there said would be endorsed by Livingstone himself. The Bible said, "Greater love than this hath no man, that a man lay down his life for his friends;" and it might be truly said that Livingstone, who went to Africa on the appeal of the President of the Royal Geographical Society, laid down his life for his friends, his associate geographers. A great point in his character was his missionary spirit. One night last week a banquet was given in the City of London to a great traveller, whereat the great traveller said that the time had come "when the romance of the missionary must be dropped." He (Mr. Stanley) did not think that time would ever come, either in England or in America. The world could not do without the missionary. The great traveller who made a speech at the Grocers' banquet said that the negro was devoid of sympathy—that he was a barren rock. He (Mr. Stanley) utterly and indignantly denied that. Were the negroes who had listened sympathisingly to the teachings of Campbell and Hamilton and Moffat in South Africa devoid of sympathy, and barren rocks? Were the coloured preachers whom Moffat sent abroad, even to the Kalahari desert, devoid of sympathy, and barren rocks? Were the Christian people of Mombas devoid of sympathy, and barren rocks? Finally, were those youths who brought Livingstone's remains over 2000 miles to the coast, devoid of sympathy, and barren rocks? Livingstone was no doddering immature man, whom pecuniary interests could lead away from that straight path which duty pointed out to him—he was a Christian gentleman who conquered both natives and Arabs by his kindness, his meekness, and his forbearance. Soft words turn away wrath, and Livingstone had used them always to advantage. This mildness of speech was the great secret which had carried him successfully through thirty-five years of travel in Africa. He did not, like this other great traveller, advocate the use of the fire, the sword, and the bullet; and the result was, that in all that part of Africa south of the Equator in which Livingstone had travelled, the white man's face was now and would be respected, because the natives would fancy that they could still hear the

honied words and see the kindly, gleaming eyes of the great traveller—Livingstone.

The PRESIDENT, before the conclusion of the evening, introduced to the meeting the Rev. Charles New, who was about to return to Eastern Africa, where he had formerly explored part of the Galla country and Mount Kilimanjaro, and who had been elected Honorary Corresponding Member of the Society. He also introduced Captain Glover, R.N., and Captain Sartorius.

## ADDITIONAL NOTICE.

(Printed by order of Council.)

### *Livingstone East Coast Aid Expedition.*

#### LETTERS FROM LIEUT. V. L. CAMERON, R.N., COMMANDING THE EXPEDITION.\*

" Konongo, 9 miles w.s.w. of Kwihaara,  
" Unyanyembe.

" SIR,

[No date.]

" It is with great grief I have to write to inform you of the death of Mr. W. E. Dillon. He had parted from me at Kwihaara, apparently better, on the 15th instant, and I was in great hopes he would get better as soon as he got away from Kwihaara, which was a very hot-bed of fever; but, after leaving, he seems to have got worse, and, in addition to dysentery, to have suffered from inflammation of the bladder. The acuteness of these diminished, but left him intensely weak, and suffering from delirium, in which he shot himself on the evening of the 20th.

" He was a thorough good fellow, and, if his health would have allowed him, would have proved most valuable to me, both as a companion and to collect specimens of the flora, &c., of the country.

" I would wish the news of his death not to be published for two or three days after its receipt, so as to give my mother time to write to his, so as to break it as gently as possible.

" I shall be able to commence regular marching in a day or two; but the task of finding pagazi is a difficult one, and they have no moral sense whatever. A man will engage, receive his advance, and walk off the next day in caravan to the coast. Chains, &c., are of no use, as one or two men seen in chains deters people from coming at all, and one cannot get a place to shut them up in; and when the askari have brought in a lot, those got together before are gone, many, perhaps, not intending to desert, but gone 10 or 12 miles off after a mat or a spear, or something they have forgotten. The chief Arabs, Said Ibn Sulim, the Governor, and Sheikh Nassib and his brother, have been most kind, and to-day thirteen of my askari, with a large party of Sheikh Nassibs, are collecting my pagazi. I am well in health, and only anxious to proceed. My eyes are so far well that I hope to get on with observations again in a few days, when weather permits. I have cloth enough to take me to Ujiji, and to use beyond the Tanganyika as presents to chiefs,

\* Continued from p. 180 *ante.*

† November 25, according to Mrs. Cameron.

and beads to last for over a year, by which time I hope either to have met Sir Samuel Baker or to have reached the west coast.

"Bombay has been working splendidly lately, and so has his second, Bilal.

"There is no change in the country between this and Kwihiara; all has been cleared except the small rocky hills, and seems very fertile; the soil is reddish loam. The rains have just commenced, but the Arabs and Bombay, in fact every one, tell me it is the right time for travelling.

"Believe me, dear Sir,

"Your obedient servant,

"V. LOVETT CAMERON, R.N."

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"MY DEAR SIR BARTLE,—

"Uganda, Dec. 4, 1873.

"I had written to you before leaving Kwihiara, but I find that poor Dillon, to whom I had entrusted my letters, has torn them all up. You will most likely have heard of Dillon's death before this reaches you, as I wrote home about it, and to the Secretary of the Royal Geographical Society. My mother has a copy of Murphy's journal detailing the facts, and will tell you all about it: it is still too painful a subject to me to dwell on.

"I must now tell you all the news of the Expedition. We arrived at Unyanyembe all well, and hoping to go on again soon: in which, however, we were fated to be disappointed. We were all more or less ill the whole time we were there. I myself had twelve attacks of fever, and was totally blind for some time from ophthalmia. Thank God, I am now as well as ever I was in my life, except that my eyes are still rather weak, and I find it prevents my sight-taking.

"I was also fearfully bothered by the pagazi: we lost about 600 dotis at Kwihiara by desertions, which, as 9 dotis equal 15 dollars, was equal to 1000 dollars.

"Some of the Arabs were very civil and friendly, especially Said Ibn Salim, Li-Wali or Governor, and Sheikh Nassib, and his brother Abdullah Ibn Nassib (Kisessa), who are in charge of the soldiers of Seyed Burghash; but others were most decidedly hostile to us on account of the news from the coast.

"They used to send men to engage as pagazi, and as soon as they had received their advance would send them away into outlying villages or in some caravan to the coast.

"In one instance I found a man had seven of our pagazi, and said he would not give them up without having three dotis paid for each, as he had advanced them that amount. I said, 'No, you have no business to take men whom you knew to be mine; you can keep them, however, if you repay me the advance I have given them,' which he refused to do. I went to Li-Wali, and through him got the men: a few days after, when I was down with fever, poor Dillon gave this Arab the 21 dotis, and when I recovered I found the 21 dotis gone and the men also, who had been marched off in chains to the coast in a caravan by this same Arab.

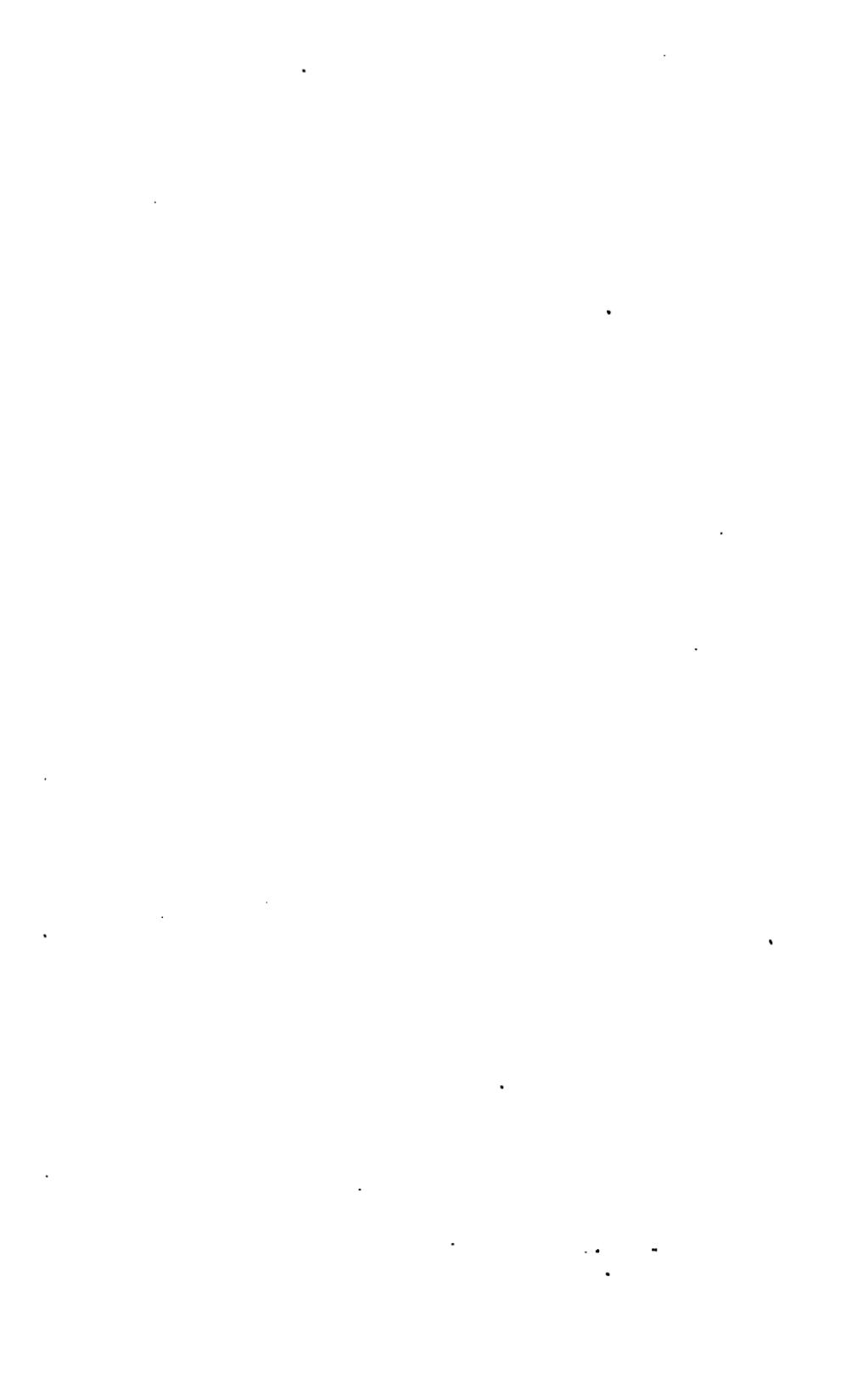
"Soon after Livingstone's caravan arrived with his body, Murphy resigned, saying that the chief object of the expedition had been attained; and, two days before we left, Dillon said he was too ill to go on: in fact, I had advised him to go some time before, as his health was so bad, and he had entirely lost the use of one eye.

"On hearing that Dillon was not coming on, Murphy at once, in the handsomest manner, volunteered to accompany me; but with the difficulty

about pagazi, and knowing that he had strong private reasons for wishing to return, I did not think it right to avail myself of his offer, besides which, he had never been fit for work since joining us at Rehenneko.

" Both caravans started on the 11th, and Murphy is now about a mile from me. Yesterday I found I had lost 10 men in the night, although I had the precaution of having askari on watch outside the village all night. I am only halting here to-day, however, to rewrite my letters.

" From here I steer straight for Ujiji. I was going a still more direct route, only I found that Mirambo had sent a large party of men to intercept us. A couple of Watusi (the herdsman tribe) had heard of our intention to go that way, and went and told Mirambo. Some of their confrères, however, told Kisese, and he shot the two men, and sent to tell me I must change my road. I am in great hopes of being at Ujiji by the end of the year, and starting over the lake at once for Nyangwe. If I am lucky about my men at Ujiji and in Uguha, and my health stands good, I think I shall reach Nyangwe about the end of February or beginning of March, and take up the Lualaba, or, as it ought to be called, the Livingstone, from that point. I am completely at sea as to whether it is the Nile, or Congo, or neither, there seem so many conflicting arguments to be taken into consideration. However, never mind, I will, p.v., solve the problem, if it is not done by Grandy or Baker before I reach there. If I find it so, I must do what I can in some other direction. My great anxiety is to solve the problem of the Lufiji and Tanganyika, or rather to hear of its being solved."



PROCEEDINGS  
OF  
THE ROYAL GEOGRAPHICAL SOCIETY.

[ISSUED AUGUST 17TH, 1874.]

SESSION 1873-74.

*Twelfth Meeting, 11th May, 1874.*

The RIGHT HON. SIR BARTLE FRERE, K.C.B., K.C.S.I., ETC.,  
PRESIDENT, in the Chair.

PRESENTATION.—*Wm. Evill.*

ELECTIONS.—Sir Thomas Dyke Acland, Bart., M.P.; Vincent Ambler, M.D.; George Birdwood, M.D.; William B. Brodribb; Charles Brooke (Rajah of Sarawak); George Edward Darroch; William Alton Dykes (Provost of Hamilton); Francis Helme Firth; Litton Forbes; T. D. Holmwood; A. C. Howard; Henry Mayers Hyndman; Francis H. Jeune; George Leeman, M.P.; Alan Lawrie McGavin; Edward Marjoribanks; Colonel A. Mitford; Richard Potter; John Procter; John Robinson, C.E.; Captain Joseph George Shanks; Edward Shelley; Captain R. W. Spicer; Major Edward Harding Steward, B.E.; E. de S. St. Jean; Joseph Edward Turner; Rev. Josiah Viney; William Walls; Sir James Watson (Lord Provost of Glasgow); James Watson; Walter Wood.

PRINCIPAL ACCESSIONS TO THE LIBRARY FROM APRIL 27TH TO MAY 11, 1874.—‘Civitas Londinum: Ralph Agas.’ (Facsimile.) By Overall and Francis. ‘Meteorology.’ By Sir J. Herschel. ‘A Journey through the Caucasus and the Interior of Persia.’ By A. H. Mounsey. ‘The Oxonian in Iceland.’ By F. Metcalf. ‘Bibliotheca Americana.’ By J. R. Smith. (2nd Edition.) ‘The Dolomite Mountains.’ By J. Gilbert and G. C. Churchill. ‘The Great Ice Age.’ By J. Geikie. ‘Lake Superior.’ By L. Agassiz. ‘Memorias del Jeneral J. P. Gutiérrez.’ (Anon.) ‘Handbook of the River Plate.’ By M. G. and E. T. Mulhall. ‘Mexico and the Mexicans.’ By C. Sartorius. ‘El Departamento de

Ancachs.' By A. Raimondi. 'Manual of Coorg.' By G. Richter. 'Notice des Monuments, &c., égyptiens du Khédive.' By Mariette Bey. 'Aperçu de l'Histoire d'Egypte.' By Mariette Bey. 'Itinéraire de la Haute Egypte.' By Mariette Bey. 'Les Missions Catholiques.' (From commencement.) 'The Moon.' By Nasmyth and Carpenter. 'Geological Survey of Canada, &c.' By J. W. Dawson. 'Mendoza Rios Tables.' (Mungo Park's copy.) 'Coup-d'œil sur l'Hydrologie du Mexique.' By H. de Saussure. 'Scelta di Curiosità, &c.' By G. Wzielli. 'Natal.' By J. S. Christopher.

ACCESSIONS TO THE MAP-ROOM SINCE THE LAST MEETING OF APRIL 27TH, 1874.—A Map on 4 sheets, showing the Gold Fields of the Trans-Vaal; by Thos. Baines, F.R.G.S., 1874. Presented by the author. 504 Sheets of the Ordnance Survey Maps. Four Index Maps to the Admiralty Charts; viz., The World, South America, England and Ireland, and Scotland. Presented by Captain F. J. Evans, c.b., Hydrographer. A Physical Map of the World, on Mercator's projection; by Keith Johnston, F.R.G.S. With Book. Presented by A. Johnston. Five Maps from Dr. A. Petermann's Geographische Mittheilungen, viz.:—1. Map of the Caucasus, showing the Physical Geography and the most important Minerals. 2nd. Map of Lybian Desert—Dr. G. Rohlfs Travels. 3rd. Carl Manch's Route in Gold Fields of South-east Africa. 4th. Theological Training Schools of the German Empire. 5th. Forests and Population of the Caucasus, Map of Northern China; by Dr. Fritsche.

The PRESIDENT said the Council had hoped before this to have been able to lay before the Society some details of the Great Australian Exploration of Colonel Egerton Warburton; but, beyond the bare fact that he and the members of his party had reached the western coast in safety, he had as yet little to lay before them. He trusted that long before the session terminated some further details of the wonderful feat of exploration which Colonel Egerton Warburton has achieved would be forthcoming. He only wished he could hold out some hopes of Colonel Warburton being amongst them this year.

He then called upon Sir John Glover to give the results of some of his explorations in the countries of the Gold Coast. He would remind the meeting that Sir John in former years had ascended the Niger to a distance far above most explorers, and he thought almost as far or farther than the place where Mungo Park met his fate. It was well known what he had done, in regions hitherto very little known, during the late operations against Ashantee.

The following discourse was then delivered by Captain Sir John GLOVER:—

*Geographical Notes on the Country traversed between the River Volta and the Niger.*

THE President has been good enough to do me the honour to ask me to give you to-night some information as to the country through which the late Expedition marched from the Volta to Coomassie. I

am afraid I have not the eloquence required for the occasion, but, in a few plain words, I shall endeavour to give you the information which our President has desired me to do.

We left England in August, and arrived at Accra in the following month. Before reaching the country which the President has described as somewhat *unknown*, it may not be out of place to mention some of the difficulties which we overcame before arriving in that country. Our first difficulty—and I may say our difficulty to the end—was the system of slavery which we found ready to combat our efforts. From the day when we landed at Accra until we crossed the Prah and left our protected territory behind us, the masters of the slaves were our most confirmed enemies—greater enemies, indeed, than we found the Ashantees after crossing the Prah. Instead of assisting us by their slaves to fight their battle, they immediately proceeded to put all their slaves in chains, to prevent their joining the Queen's forces. That, of course, we overcame. The Houssa men broke down the King's prison, chopped open the chiefs' heads, and committed minor offences of that sort. Of course I had afterwards to make things sweet and pleasant. I will not detain you longer on that subject, except to say that we started from Addah, and crossed the Volta at Blappah, effecting our crossing in three days.

We succeeded in putting across the Volta 17,000 men, and as I was sent out commissioned only to raise and equip 10,000, I think that you will agree with me, as the Government have been good enough to recognise our efforts, that we succeeded in accomplishing what we were sent out to do. When I say that, I speak also of my gallant friends who assisted me, and without whose co-operation we should never have reached Coomassie.

The day after Christmas-day (1873) I received orders from my General to march with a disciplined force of a thousand men, so as to cross the Prah on the 15th of January. I was successful in doing so at noon on the 15th, the day the General named. I may here describe to you what will be of more interest, perhaps, to the Royal Geographical Society than anything else, and that is—what we saw of the country.

After leaving Odoomassie and Akropong the forest-country begins, and the region of mountains over which we were continually ascending and descending going up to Ahabante and Kukerantimy, was entirely forest; and you cross over three ranges of mountains. I may say our great difficulty was to prevent ourselves from falling down the gold-pits which were dug on each side of the road. The natives there have only an idea of sinking a shaft;

they have no idea of working a gallery underneath, so that, in a space equal to this hall, some forty gold-shafts would be sunk: they only then remove the soil at the bottom of the shaft, which is capable of simply allowing the body of a man to pass down. I need scarcely say that, with the appliances of science, there must be a great deal of gold there yet to be produced. The mountains are entirely composed of quartz and granite. The rivers over which we passed are all dammed up for the purpose of washing gold; and I am quite sure—were that country explored by scientific men, geologists, and others—a very rich field of gold might be found.

From Accra to Abokobi is 10 miles, over a hot and sandy plain. Immediately after leaving Abokobi you ascend the mountain of Akropong. When you come to Abune you attain an altitude of 1600 feet. At Akropong you are 200 feet higher, and from there, until you reach the River Amoom, the entire line of march is over a country marked by the gold-shafts which I have described to you. The danger is that, having to escape from one, before you recover your proper equilibrium you are very nearly going down another, because the path is not so wide as this table, and the gold-shafts are thickly studded all along its sides.

The people are so very idle, that I should think they would even be too idle to interfere with any one enterprising enough to go out and dig the gold on their farms. All along our line of march the tyranny of slavery was fully in operation in every way to impede our progress, in the shape of hindering us from obtaining carriers for our provisions and ammunition; and to such an extent was this carried, that it was determined at last to sacrifice everything, even our necessary supplies of provisions, for the sake of getting up ammunition to the enemy's country.

I may here mention that a small case of ammunition, containing 420 rounds, cost in carriage from the Volta to the Praha £. 14s.; therefore you may suppose, when we had to carry up some 300 or 400 boxes, what the expense was for carrying up the ammunition alone for our very small force of disciplined men.

The Berem River is said to be very rich in gold. After the floods, large boulders are washed down, which break when brought in contact with one another; and, when the river is low, the natives go down and secure a very large quantity of gold from the boulders which have thus been split open by the force of the current. Coming to Odoomassie, and, indeed, from the line of the Praha River to Odoomassie, the gold-pits increase in number, and, instead of the shafts being sunk 18 and 28 feet deep, you find gold-pits like common gravel-pits in England. I think I have remarked

that, on leaving Odoomassie, the forests begin, and I am sure we never saw 100 yards in any direction clear before us or around us, except in the clearings at Coomassie and the villages around it, and on the line of Sir Garnet Wolseley's march, until we came to the top of the Adansi Hills, where a large clearing had been made for the camp. There we saw a distant hill, perhaps a thousand yards off, but we certainly never saw more than 200 yards in front of us from the time we left Odoomassie until we reached the Adansi Hills.

I may say a word as to the entire absence of animal life and of all birds. There was no antelope, no leopard, no birds, except a few parrots which sometimes screamed from the tops of the trees. The only things we were troubled with were ants and snakes. I may also mention that, after crossing the Prah, and taking the first town, Obogoo, we succeeded in surprising and capturing some 200 sheep. After that, every place we approached was clean swept. We never saw the feather of a fowl until we were fortunate enough to fall in with Sir Garnet Wolseley's rear-guard, when we were regaled with beef and with all the luxuries at his command.

I think the map exhibited hardly goes far enough north to describe to you what may be very interesting to future geographers, as well as to the future of the Gold Coast. Some 200 miles north of Ashantee there is a large town called Salga. Salga is the southern outpost of a Mahomedan Power, and was formerly tributary to the King of Ashantee. It paid him a great sum yearly in money, and also some 600 slaves. They lately felt themselves able to refuse the payment of tribute in men, and, indeed, only gave him a very small subsidy in money. As soon as I landed at Accra, a deputation came down to me from this town to say, "Only come up to us, and the power of the Ashantees will be broken." I am quite sure that, as soon as this country shall reap the fruits of Sir Garnet Wolseley's victory, and the River Volta shall be opened to peaceful trade, a very large field—not only for commerce, but for exploration—will be opened up through a country, hitherto unknown, lying between the Volta and Timbuctoo to the north-west and the Niger to the north-east.

I may mention that the entire country east of Coomassie to the Volta, and nearly up to the region of the Mahomedan tribes, has given in its adhesion to the British Government, and has refused its allegiance to the King of Ashantee. It will, therefore, be seen that the result of Sir Garnet's victory will be, that the entire south of the Ashantee kingdom from Coomassie, and eastward to the Volta, and north-east beyond, has fallen away from the King of

Ashantee. Therefore, whatever may be his objection to keeping the treaty, I believe his power is gone; and the results to civilisation, I think, I need scarcely point out to you. There is one thing most important. The steamers, which leave Liverpool, reach Accra in 22 days; therefore you have only a march of 10 miles across the plain, and you immediately attain an altitude of 1600 feet. The mornings there are cool and pleasant. Europeans have lived at Akrapong for thirty and even thirty-five years, and I have seen children going home for the first time to Europe, six and eight years old, born in those mountains. I therefore see no objection to the exploration of that country being carried out, and the really rich stores of gold, which it produces, opened up to our enterprising miners, who, no doubt, will go up there.

As I have said before, the steamers from Liverpool could take you to Accra in 22 days; and I think, beyond the disagreeable experience of a sea-voyage, nothing more is to be met with after you have once landed at Accra. As I said, you have only 10 miles of plain, and beyond that you have a pleasant altitude of 1600 feet, with forests in which you may walk without even your hat on. The country towards the Niger, far to the north, is all a large open prairie-land with clumps of trees and tall grass. It is a country in which all kinds of animal life are found. I may tell you that a bullock costs at Salga 4s. 6d., a sheep 6d., and fowls about 1d. each. Here are tribes of Mahomedans, whose great power is in their cavalry; and I have no doubt, the power of King Coffee Calcalli having been broken, these enterprising men will press down to the Coast, to taste the sweets of what they call the white man's trade.

With regard to agriculture, I am afraid the Ashantees are somewhat backward. I found nothing but green plantains on our line of march, and a very few yams, which I may describe—to those who do not know what they are—as very large potatoes. But these are only found in very small patches of the forest, and they seem to be very careful only to clear away just as much as will supply their simple wants. I must tell you our road was a simple hunter's path, until we got within some 12 miles of Coomassie, where the villages began, and there the roads are better: I suppose, in order that the lieges of the King of Ashantee, when called upon to deliver their heads to his Majesty's pleasure, may be able quickly to perform that duty. There is no trade with Coomassie, or any other place (except Cape Coast Castle), other than what is required to supply their wants in rum and cloth.

The timber of these forests is most magnificent. You see trees of a kind half teak, half mahogany, which tower up 180 feet before you come to a single branch. There is a tree called the "Aboo," which is very valuable there, though I doubt whether it could be brought to England. There can be no question as to the amount of gold which is to be obtained there. As I said before, the distance from Accra to the gold-producing region is so short, it is only a matter of time before, I suppose, we shall be all eating with gold-handled knives and off gold plates.

It was supposed that horses and mules would not live there. Now, we took with us six horses from Madeira and three mules. All I can say is, that, with the very little care which we were able to give them, these horses lived till we came down within three days' march of Cape Coast Castle, when they suddenly succumbed for want of grass; but eastward on the plain bordering the Volta, and in the Akropong mountains, they lived remarkably well, and it was only when we came to a forced march and found no grass in those forests, that they began to give way. I am also afraid to confess to the company present, which includes so large a number of ladies, that we were so ungallant as to press the ladies into our service to carry our stores for us. If I should ever be called upon to go out again and raise a force to oppose an enemy on that coast, I should most certainly recommend Her Majesty's Government to call upon the ladies of the Protectorate to take musket and gun, and leave the men alone at home. I may also say that there was nothing that created more terror in the minds of our very troublesome faithful allies than when, on more than one occasion, I threatened to burn their camp and send them back home to their women. That seemed to alarm them more than anything else, and I assure you I did not spare them.

At Akropong, at Khebi, at Kukerantimy, at Abune, at Abokobi, at Addah, and at Accra, there are Mission Stations belonging to the Basle Mission, and I am delighted to have the opportunity of bearing testimony in public to the kindness with which they received us at all their stations, the hospitality they were enabled to afford us, the assistance they gave us in providing skilled artificers for our force in the shape of carpenters, blacksmiths, farriers, shoemakers, and also for putting in the field 200 very capital soldiers; indeed, in fact, the only reliable men that I raised in the Protectorate except the Houssas. Their Mission Stations along the whole line of march as far as Khebi were always open to us; their clear ground always formed our camp. At Akropong they had very large plantations of coffee and tobacco. Their system, I was going to say, of Christian-

izing the natives is also to teach them the useful trades, which I tell you they provided us with artificers in; and I am sure a great future is before them, and for the results of their system of education and Christianizing the natives.

I may give you an instance of the difficulties we sometimes had to meet with, not only from slavery, but also from the fetish. At Assuom I was very careful that my camp should be pitched outside the town, so that they should not be molested in any way. When I reached there the Chief came out to see me. I hoped that he would express the gratitude he felt for the care I had taken that he should not be troubled with our people in his town. But I was very much astonished when he said to me, "One of your men has fired off a gun on a day on which our fetish forbids any gun to be fired or any work done;" and these fetish days number some four days out of the seven. I expressed my regret that anything should be done to annoy his Majesty or his Majesty's Fetish; and he said very coolly to me, "I am going to fine you." I explained to his Majesty that we had come there to help him against his enemy, the King of Ashantee, and that we hardly expected to be fined for what was at all events an accident, and not intended. But he said that such was the case, and he would consider what the amount of the fine should be, and I must pay a fine. I thought I had better end that by fining him fifty carriers, which I did. His Majesty then saw the error which he had committed, and I am afraid to state that part of his fine was paid in women. However, I was very glad to get over the difficulty in that way.

I told you, when opening my address, I was afraid I had not the eloquence which would do justice to the occasion which has brought me before you. I can only say, if there is any gentleman who would like to put any question to me, I should be most delighted to answer him and to give him the information he desires, if it is in my power.

Sir GARNET WOLSELEY, on being called upon by the President, said that when he entered the service many years ago, one of the first lessons he was taught was that the greatest misfortune that could possibly occur to an officer in Her Majesty's service was to be taken by surprise. He was sorry to confess at the present moment that he felt in that very uncomfortable position. He came there, having been kindly invited, to listen to a paper by, he hoped he might call him, his friend Captain Glover, who certainly was one of his most able colleagues during the late war. He had, therefore, not come there prepared to make a speech. Captain Glover had so minutely described the country through which he passed that he had left him but very little to say. There were one or two points, however, that perhaps the meeting would like to hear a word about. First with regard to the supplies. Captain Glover had spoken of the great difficulty he had in finding supplies, and he must say that his difficulties were quite as great—that he found the country

through which he passed inhabited by a people who were a hungry people, but had very little to eat. The daily food of a large portion of them consisted of snails; but the snails were certainly of a very large size. Even in Cape Coast Castle these snails were seen sold on a stick; they fry them, after having dried them in the sun. Of course they had yams and plantains. With regard to sheep or fowls, he did not think, during the whole march between Cape Coast Castle and Coomassie, he ate a portion of a sheep or a fowl that came from the country. All supplies had to be drawn from neighbouring countries, and even from England. The country they passed through was very much the same as that described by Captain Glover. It was a forest country from first to last. Of course round Cape Coast Castle and in the immediate neighbourhood of our posts the forests had been from time to time cut down—the primeval forest—and its place had been taken by a large undergrowth of from 20 to 30 and even 40 feet high. Beyond that zone of underwood we get into the primeval forest, and there, as Captain Glover had said, the trees are of an immense size. They were very peculiar trees, mostly baobabs, mahogany and iron-wood. In describing a tree in those regions, the best way of bringing home to the people who have never seen them some idea as to their size and shape, is by saying that they were like a large candlestick,—a great big stem, and nothing else, with a large top. The best representation of the size of one of those trees in our country that he could give them was Nelson's monument in Trafalgar Square. A good sized tree was quite as large round the girth, and quite as tall, and had no branches except at the top. In marching through this country there was a great undergrowth, so that you could never see any distance, and in fact after you had been marching through it for some days the first impressions wore off very quickly. First of all, you said, "How very grand these trees are!" but after you became accustomed to them and to the creepers and the vegetation generally, it quickly palled upon you, and you got thoroughly tired of it; so much so, that the only description he could give of the march to Coomassie was, that it was like marching through the Thames Tunnel—a tunnel of trees. They very seldom saw the sun, which was perhaps very fortunate for them. They saw very little of their enemies, though they occasionally unfortunately felt their effects. The geographical information obtained of the country was, as far as the Expedition went, considerable—wherever our columns went the country was very carefully and accurately surveyed. Astronomical observations were taken wherever they went; the latitudes and longitudes of the various places we arrived at were laid down; and he was happy to have here the opportunity of bearing testimony to the able services performed by a very gallant officer who, he was sorry to say, lost his life there—an officer under whose able directions most of those observations were taken and nearly all these surveys made. He alluded to a very great friend of his, an officer who performed very good service on a previous occasion when he had the honour and pleasure of being associated with him—Captain Huish. Sir John Glover had paid a very great tribute of respect to the negro women on the coast, and he could corroborate his statement most fully. The men as carriers were nearly as unreliable as they were as soldiers. When he first went there he had most high notions of being able to call upon their honour, and appeal to their patriotic feelings, and to try to develop some love of country among them. He was most averse to coercive measures; but he found, after some stay, that a man whom he had often read of, he meant the King of Dahomey, and to whom he had often heard reference made, was a man of very considerable wisdom—a wisdom which he appreciated—because he kept a large army of Amazons. The women were really a far finer fighting race than the men, and the King was quite right in leaving the men at home to look after the children while the women went out to fight. When he arrived in the country he found it was

customary when war was declared for all the men to leave their villages and go out to fight. When the men were gone the women collected in large bodies, painted their faces and their bodies white, and scoured round the towns with brooms. If they caught an unfortunate man they fell upon him and beat him. After the men had been ordered out from Cape Coast Castle, he had a levee one day, or perhaps he ought to say, a drawing room. It was a crowded one, as drawing rooms very often are; all the ladies of Cape Coast Castle were there; they came and told him that they were very anxious indeed that all their brothers, fathers, and husbands should go out to fight for the English, and they said they were prepared to give any man they might catch in the place a good beating. He told them he hoped they would give him an additional one on his own account.

The effect of opening the road to geographical discovery, as the Expedition had done, he thought, effectually, would be to throw open the interior of Africa in a manner that it had never been done before. When he arrived upon the coast he found the name of England at the very lowest possible ebb. No one in Africa had the least respect for the name of England; but, when the Expedition left, he had no hesitation in saying that, through the valour of her Majesty's army, navy, and marines, and the officers and men that he had the honour of commanding, the name of England was left upon the highest pinnacle that a nation could be left upon as regards its reputation on that coast. But, sentiment apart, the practical result would be that future explorers would have a very easy task in penetrating into the interior, relying upon what has been very much abused in this country, namely, the prestige of the arms of England. These arms have left behind them such an indelible mark upon the country, and we have marked upon the face of Ashantee a memento of the power of England so deeply imprinted in the minds of the people, that he did not think any explorer would have, for many years to come, any difficulty in penetrating into the very heart of Africa, certainly from the western portion of it.

He had not the opportunity of passing through the same gold-bearing districts that Captain Glover had; but, to convey an idea of really how rich the country must be in gold, he had himself seen at Cape Coast Castle, after a shower of rain, old women, who could not, perhaps, otherwise obtain a livelihood, washing for gold in the gutters of the streets; and although the amount of gold was, naturally, very small, as they had been engaged in this employment probably from time immemorial, they were, no doubt, enabled to get a sufficient amount of gold to afford them a livelihood. This was sufficient alone to prove that the country is teeming in gold. Where the main deposit of gold may be, has to be discovered hereafter by those gold-miners to whom Sir John Glover had referred as, perhaps, at some future time going out there in search of it. He would not himself care to be one of those gold discoverers, because he thought it the most horrid climate that one ever had to do with. It is a climate in which the first question you ask every day is, "Who is ill?" and as every man comes to you to do business, before he tells you what it is, you look him in the face to see whether he is ill of fever or not. He could not, therefore, hold out much hopes of pleasurable excitement to the gold-seekers who might intend to visit that coast. No doubt those who survived—not a very large number—would bring back a considerable quantity of gold. The gold as manufactured by the people of Ashantee themselves has been exhibited in London for some time, and it certainly is of a very curious nature, bearing great resemblance in form and shape to Egyptian patterns; so that there must have been at some time or other in the history of the world a connection between the East of Africa and the West. This is further borne out by the great jewel of the country—if it might be called so—the Accra beads. It is a bead very little known, but they tell us on the coast it is found

in the interior of Africa about Lake Tchad, and that great numbers of them are dug up there; but no one knows when they were made, how they were made, or where they came from. They are evidently of Egyptian construction, and must have been manufactured at some very early period of Egyptian history.

No one knows what the Ashantees worship. They may worship anything—an old pair of boots, or anything that they may happen to take a fancy to. Along the roads by which the Expedition marched the most curious things were found worshipped. In many places, every tree had a small piece of white linen fastened to it; and old chattels, earthen pots, stones, jaw-bones of human beings, and various teeth of animals, were found collected about trees, all of which they evidently worshipped in some peculiar way. They seem to have a very curious idea of a deity; but the fixed idea in their minds is not of a good deity, but of an evil spirit.

One of the greatest results that we looked forward to from the late war was one which England might regard with pride, namely, that the breaking up of the Ashantee kingdom would bring about the abolition for ever of the practice of human sacrifices. Some long time ago, human sacrifices were quite as common in the neighbourhood of Cape Coast Castle as they were in Ashantee. When people in England talked of the horrors of human sacrifices in Ashantee, they forgot that the countries over which we ruled were formerly given to these practices quite as much as the Ashantees were at the present moment. The last news he had heard from the coast was that the King had sent down one of his sons to be educated at Cape Coast Castle, and he had told the rulers there that, although he could not prevent these sacrifices, he would mitigate them as much as possible. When the Expedition entered Coomassie it passed by a very large sort of jungle-grass place, where they threw all the bodies that they sacrificed. The principal medical officer of the force on the evening they arrived in Coomassie happened to be billeted in the house of the chief executioner. During the evening, he asked him a great number of questions with reference to the number of sacrifices that had been made during the last year. He spoke in a manner in which you might hear a butcher very often speak. When he was asked how many men he was in the habit of killing, he said, "Well, the fact is we kill every day. We do not kill on Fridays and Sundays, but we kill every other day." And, upon being asked how many men he generally killed, he said, "Sometimes we kill five, sometimes ten, sometimes twenty." He was asked how many he had killed during the year. He said, "Well, I cannot say, but I should say between two thousand and three thousand up to the present time." The place into which the bodies were thrown was close to where the naval brigade were bivouacked for the night, and some officers went in, and from them he learned the horrors of the place. It was a deep sort of glen, and was a perfect Golgotha. In the foreground there were twenty, or thirty, or forty, fresh bodies, and the remains of thousands and thousands of others. It was the most fearful place that the medical officers who described it had ever seen, and they had seen very curious places; they said they had never contemplated anything so horrible. If, therefore, we could look forward to no other result from this war—though certainly he was hopeful enough to look forward to many other results of benefit to England and the civilised world as accruing from it—still, if no other result was to be obtained than the lessening or the eventual abolition of this horrible system of human sacrifices, he thought the blood we had shed, the lives we had lost, and the treasure we had expended, would not have been expended in vain.

In order to put a stop to the internal wars of Africa, by which slaves are obtained, there was only one real means by which it could be done; and this means, he was sorry to say, would not be very acceptable to a great number of

the mercantile community of this country. It is by prohibiting for ever all importations to any part of the West Coast of arms or ammunition. By stopping the importation of powder and guns, you stop the means of making war, and by stopping the means of making war you stop all means of getting slaves, and therefore you put an end to human sacrifices. We spent millions of money in the abolition of slavery; we kept up an expensive squadron of ships on the coast for many years, losing the valuable lives of sailors and marines, and yet slavery still exists on the coast, and wars are still carried on. If the same means that were adopted for putting an end to slavery and the exportation of slaves were adopted with reference to the importation of arms; if there was an international convention of nations—and he was sure no nation would dare to come forward and say they would not join it—if all nations agreed to allow ships to be visited and to prevent the importation of arms on the West Coast of Africa, he did not think we should ever have a war there again.

Captain the Hon. E. R. FREMANTLE, C.B., C.M.G., R.N., said that he was afraid, although Sir Bartle had been kind enough to introduce him as an old member of the Society, what he had to say would not be very interesting after the highly important and interesting speech of his friend Sir Garnet Wolseley, with whom he had the honour to co-operate.

He could confirm what was said by Sir John Glover as to the utter want of animal life on that part of the coast. It appeared to him, from a not very extensive experience, that animal life, like human life, was exceedingly scarce where the bush or forest is exceedingly thick. About Cape Coast there was very little animal life, and what there was consisted, at any rate as far as he could see, of ants. He had the curiosity, a few days after a little skirmish near Dunquah, in which his friend Sir Francis Festing was engaged, to go over the battle-field only three or four days after the action. He had not been engaged in that action, and felt a curiosity in going over it, though he was warned not to do so. He was told by the interpreter, in language which he had no doubt was excellent English, but which struck him as a little curious, that if he went there he would find it "corrupt." Well, he found that it was indeed "corrupt." He would not dwell on the many dead bodies about, but the ants were exceedingly numerous. When he saw a large quantity of ants and thought "Ah! here is a curiosity," after the first experience he found he had better step on one side, because it was a body. It was extremely difficult to see for any distance owing to the thickness of the bush. He recollects that when his friends of the Staff, some of whom were left behind, all of whom were exceedingly energetic and zealous officers, when they came out their zeal surpassed all bounds—they came there with spy-glasses slung over their shoulders. They went through the bush in the most energetic manner and surveyed every place within a region of several miles from Cape Coast; but they soon found that to carry spy-glasses was a delusion, for you can never see more than a few yards' distance. Here, at all events, the soldier and the sailor were on equal terms—no one knew that in the very next bush there might not be an Ashantee ready to fire. That was the excitement of the thing, no doubt; but it was not exactly warfare, according to the ordinary military pattern, and our spy-glasses and our general information as regards warfare were a little at fault. So much for the nature of the country.

The old tradition is, that Ashantis and Fantis descended from the same stock; that they went to war together on one occasion, and divided into two parts, one going to the right and the other to the left. One part lived upon a certain root called Fanti, and they turned into Fantis, and lived in that part of the country; and the others turned into Ashantis. How far that may be true he knew not, but this he could say, from his own experience, that the languages are almost exactly identical; that a Fanti can scarcely

tell, except by the intonation of the Ashanti, whether he is speaking Fanti or Ashanti. They might be dialects of the same language; but certainly their languages are almost exactly similar. We had heard a great deal of the cowardice of the Fantis and the extreme courage of the Ashantis. There is a certain amount of truth in that statement, but we are a little inclined to exaggerate both the cowardice and the courage. We are behind the scenes with the Fantis. We see, when we say to these Fantis, "Come on!" they do not always come on. Well, this is awkward; but we do not see when Amanquatiah, or any other of the chiefs of the Ashantis say, "Come on!" (to the Ashantis) and they do not come on. We merely know that they are there in the bush; they do not move out to attack us, and our friends will not move out to attack them. That is their system of fighting; and those officers engaged in the early part of the war said that, when Fantis alone were arrayed against Ashantis, their system of fighting was this: they cleared a certain portion of ground in front of either army, and that being done, and a certain amount of war paths cut, they thought now was the time to have a little fight. They went along their war paths from their camp till they came to the open, and there they stopped. The courageous people fired, and the other courageous people on the other side also fired. This was a very interesting engagement, and occasionally some very bold man came out and showed himself; then there was more fire. At last one side or the other, generally the Fantis, got short of ammunition, or were a little deficient in courage, and they retreated; and when the Fanti retreated, the Ashantis occupied their ground. Because you cannot get the Fanti to move on is no reason that they are so exceedingly cowardly. As regards commerce, "The Ashantis are our principal traders," said a gentleman who had a very large trade on the Gold Coast. But what was this commerce? He (Captain Fremantle) had reluctantly a part in stopping this commerce, by establishing a blockade, which was tolerably effective. This trade on our side was selling to them guns, powder, rum, and tobacco: very important articles, no doubt, to the Ashantis. No doubt there was also a great deal of cloth sold. But what was the export of the country? These goods were paid for almost entirely in gold-dust. The Ashanti produces nothing. He digs up a little gold, and that is all. He comes into the Fanti territory, destroys everything that he comes across, cuts down the groves, all the palm-trees, prevents them from making palm-oil, and prevents the country from being productive in any way. The Fantis, although they may be very cowardly, certainly are a little more productive. They manufacture a great deal better jewellery than the Ashantis; they do work in certain respects, they pay attention to this palm-oil, and they do a considerable trade in that article. If you begin to civilise an Ashanti, the first thing you will produce is a Fanti. Therefore, when we abuse the Fanti we must judge also of the Ashanti exactly as we find him; a very fine, noble savage, addicted, no doubt, to human sacrifices, and to many other customs which we do not exactly approve of in this country. His chiefs and kings, on a particular occasion, like to do "custom." If a king's son dies, if he happens to be killed in an action at Elmina, or something of that sort, it is exceedingly expedient to be able to cut off the heads of all the slaves that have been a little unpleasant to you. If you have had an unpleasant word with a servant, you know, it must be a very agreeable thing to cut off his or her head; at least that is their impression on the subject, and that is what the "noble savage" does. A great deal of very false sentiment has been thrown away upon the "noble savage." Some of these days civilisation will reach him, and the sooner this happens the better. But you must either have the "noble savage," *pur et simple*, with king and chiefs cutting heads off, and all the rest of it, or you must take him in a certain process of incubation. The first thing he learns or unlearns when

civilised is that abject submission to his king and his chiefs that leads him to go on his own track, and not to be very much afraid of his superiors. He is naturally a lazy individual, and he gives way to his laziness. On the other hand, he learns the importance of trade; he learns it is some advantage to fill his pocket; and he gradually assumes the arts of peace, and those arts of peace are surely of some considerable importance.

With regard to the climate, he (Captain Fremantle) could not say he had felt any very great ill effects from it; but it struck him on his first arrival that the atmosphere had a heavy leaden feeling, and so it was all the while he was on the coast. He thought this might have been some misapprehension on his part, because people get accustomed to this atmosphere, heavy and laden as it was. But when one saw the mists rising every morning, especially in the rainy season—when you saw the water alongside the ship full of vegetable matter—when, if you moved your paddles, there was a most unpleasant effluvium—you felt that all this was not only unpleasant, but that there was an atmosphere of unhealthiness about it. On leaving the Gold Coast for a time, he had not got a hundred miles out before he felt the greatest relief, although the thermometer was not lower. But on returning to the Gold Coast again he felt the same depression. If you walked a mile or two you felt overcome. He could not help thinking that this was very much due to the quantity of bush round about, and the stagnant swamps. With increased money spent there and more civilization, the bush might be cleared away, the swamps drained, and facilities created for going from Cape Coast, say to the Akropong hills or other mountains where it is comparatively healthy, and if you did so you would make the place very different from what it is at present.

Mr. HUTCHINSON said that what had fallen both from Sir Garnet Wolseley and Sir John Glover quite confirmed the view he and those who went with him had taken with regard to the future of the West Coast of Africa, more especially the parts near the Gold Coast, in consequence of the campaign so successfully terminated there. Sir Garnet Wolseley mentioned the King of Dahomey. That king appeared to have regularly adopted the plan of attacking the very peaceful city of Abbeokuta; and one of the results of the Ashantee campaign is, that we hear the King of Dahomey, instead of attacking Abbeokuta, as he usually had done for his autumn manœuvres, had drawn off, and manifested no intention of doing so. As to the introduction of Christianity and civilisation into those parts, he was glad to hear Sir John Glover speak of the praise and honour that was due to the work of the Bâsle Missionary Society. They had done a noble work in that part of the world, and they were prepared, notwithstanding the difficulties they had experienced, to go there again and occupy the same places from which they had been driven; indeed, the very men who were in captivity were prepared to return to Coomassie, if an opportunity was afforded them. He thanked Sir John Glover, in the name of the Church Missionary Society, for the noble testimony he had borne to the conduct and steadiness of the 200 Christians, the results of the work of the Bâsle Missionary Society, who accompanied him in his campaign. He was much pleased to hear Sir Garnet Wolseley say one of the results of the campaign would be to put an end to the abominable and odious system of human sacrifices. He mentioned this, because in the recent debate in the House of Commons more ignorance was exhibited on the general question than could have been expected from our legislators; a statement being made that one of the results of the abolition of the slave-trade on the West Coast of Africa was, that the population now pressed so fast upon the means of subsistence that they had to resort to human sacrifices to keep them down. He hoped such statements would not be made again, and that the result of the war would be that no more human sacrifices would be heard of either in Dahomey or the kingdom of Ashantee.

The PRESIDENT, in returning thanks to the officers and gentlemen who had addressed the meeting, congratulated the audience on the amount of information that had been elicited on a variety of topics connected with the little-known countries of the Gold Coast. Our more immediate concern was with the geography of the subject; and with regard to this, all members of the Society would be glad to hear what had been said as to the opening up of this most interesting country, which was anticipated as the result of the successful operations of Sir Garnet Wolseley and his gallant companions by sea and by land. It appeared as if, for the first time, the veil was lifting up which had concealed the interior of Africa from our view. These expeditions, though they might not reach beyond a few hundred miles, showed the possibility of penetrating far into that unexplored interior when once you were out of the reach of that leaden atmosphere which had been so well described by Captain Fremantle. The very interesting account which had been given of the effect produced by only one generation of those noble German missionaries who have established themselves at Akropong and other places in the interior—what you have heard of their determination not to be deterred in the noble work they had undertaken—all show that when the nations of Europe who join with us in their desire to know more of the interior of Africa once apply their minds to the task, it was not such difficulties as have hitherto excluded us which would keep them out from the interior. It was quite clear to those acquainted with such savage nations as Sir Garnet has been dealing with, that such a lesson as his, once taught them, would not be soon forgotten, and that the memory of Sir Garnet and his companions would live long after they have joined those noble companions whom they left behind them on those shores.

*Thirteenth Meeting, 1st June, 1874.*

THE RIGHT HON. SIR H. BARTLE FRERE, K.C.B., K.C.S.L., ETC.,  
PRESIDENT, in the Chair.

PRESENTATIONS.—*John Robinson, Esq.; Captain J. A. Elmslie.*

ELECTIONS.—*William Boyle Barbour, Esq.; John Blanch, Esq.; James Brogden, Esq.; Alexander M. Bruce, Esq.; John Oldfield Chadwick, Esq.; Colonel James Davidson; Captain S. Hoskins Derriman, R.N.; William Dunn, Esq.; James A. Elmslie, Esq.; Captain Robert O'Brien Fitzroy, R.N.; Francis G. Goodliffe, Esq.; R. W. Hanbury, Esq., M.P.; George R. Le Pays, Esq.; Robert M'Ilwraith, Esq.; Hugh Brown Muir, Esq.; James Mitchel Padmore, Esq.; John T. Primrose Pechey, Esq.; Major-General Deighton Probyn, V.C., C.B.; Captain Francis William Rankin; Francis W. Cuthbert Read; George Russell Rogerson; Captain Charles Warren, R.E.; Owen W. White, Esq.*

PRINCIPAL ACCESSIONS TO THE LIBRARY SINCE 11TH MAY, 1874.—  
 ‘The Surface-Zones of the Globe.’ By Keith Johnston. ‘Handbook for Colonists in Tropical Australia.’ By G. W. Earl. ‘Illustrations of China and its People.’ Vol. IV. By J. Thomson. ‘Album of 56 Photographs of Rio de Janeiro and its Environs.’ Presented by C. H. Wallroth, Esq. ‘The Naturalist in Nicaragua.’ By T. Belt.

'Through Russia.' By Mrs. Guthrie. 'Campaigning in Western Africa.' By Captain Rogers. 'The Wild North Land.' By W. F. Butler. 'The Land of Moab.' Second Edition. By H. B. Tristram. 'Jonas Hanway's Voyages.' Second Edition. Presented by the Rev. J. Crane Wharton. 'Tent Life in Siberia.' By G. Kennan. 'Shanghai Reports and Letters, by Baron von Richtofen, on various Chinese Provinces.' Presented by J. Anderson, Esq. 'Adventures in Morocco.' By G. Rohlfs, with Introduction by Winwood Reade. All the last editions of Murray's 'Hand-books.' Presented by J. Murray, Esq.

ACCESSIONS TO THE MAP-ROOM SINCE THE LAST MEETING OF MAY 11TH, 1874.—54 Sheets of French Charts and Pilotage Books. Presented by the Dépôt de la Marine. A MS. Map of Central Asia near Kuldja. (lli.) Presented by Baron F. Osten-Sacken. 9 Sheets of Admiralty Charts. Presented by Captain F. O. Evans, c.b., Hydrographic. 3 Maps of the Trans Vaal Republic. By S. Baines, F.R.G.S. Presented by the author.

Before proceeding to the more immediate business of the evening, the President introduced to the meeting two of Dr. Livingstone's faithful native companions, who, he said, were well known as Chumah and Susi. He was sorry that Mr. Horace Waller was not able to be present to introduce them, because he was on the Shiré, with Bishop Mackenzie, when Chumah was released from captivity in Dr. Livingstone's former journey. What Chumah and his companions had done since then, the meeting knew in part; but he felt sure that, if they were acquainted with the whole history of these excellent men, they would respect them even more than they did at present, and that they would pay them such a tribute as Englishmen knew how to pay to duties strenuously performed. There was a circumstance connected with one of Dr. Livingstone's party who was not then present which, he was sure, would come home to the feelings of all. Mr. Waller had kindly sent him information of an incident which had occurred to Mabruki, one of the companions of Chumah and Susi, namely, that when he arrived at Zanzibar he found among the slaves at that place his own sister, and had had the satisfaction of releasing her from captivity. He (the President) only wished that their guests were able to address the meeting in some language that would be intelligible to them, or that Mr. Horace Waller, to whom their presence was due, had been present to interpret for them; but he was certain that the meeting would show them how welcome they were at the Royal Geographical Society that evening. He might mention that both of them were with Dr. Livingstone during his Zambezi journey, and that Chumah had accompanied Dr. Livingstone to Bombay after his adventurous voyage across the Indian Ocean in his river steamer *Lady Nyassa*. Chumah was placed under charge of Dr. Wilson, of the Free Kirk Mission, and during the time that Dr. Livingstone was in England he was doing his best to make up for the defects of his African education, and made considerable progress in the English language; his proficiency in which would, no doubt, be very much increased during his present stay in this country. His companion Susi was, during the same period, on board ship, where he learned a great deal that would be useful to him in after life as a sailor.

The President then, in allusion to the paper of the evening, said, he

need not remind the meeting that the subject of Oceanic Circulation was almost a new science, and that it owed more, perhaps, to Dr. Carpenter than to any other living man for its modern development. He would not attempt to anticipate what Dr. Carpenter would state with reference to the light which had been thrown upon the science by recent discoveries, the fruit of the different scientific voyages undertaken during the last few years principally at the instance of Dr. Carpenter himself. It was sometimes objected to these researches that they were mere matters of speculation ; but if their bearing, not only upon physical geography, but upon other subjects relating to the welfare of mankind, was considered, it would be found that there were fewer subjects of more practical importance to mankind than these investigations.

The following paper was then read :—

*Further Inquiries on Oceanic Circulation.* By WILLIAM B. CARPENTER, M.D., LL.D., F.R.S., Corresponding Member of the Institute of France.

#### FIRST PRINCIPLES.

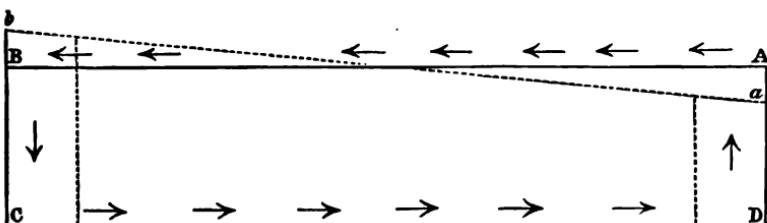
1. RATHER more than three years ago (January 9, 1871), I placed before the Royal Geographical Society, at the instance of its distinguished President, the late Sir Roderick I. Murchison, an account of the researches in which I had been engaged during the previous summer upon the Gibraltar current ; with the bearing of the Physical Theory which I had been led to adopt, as affording the *rationale* of its phenomena, upon the question of a *general* Oceanic Circulation sustained by difference of Temperature alone, altogether independent of those *local* currents produced by Winds, of which the Gulf-Stream is the most conspicuous example. "No one," I said, "can be more sensible than I am myself, that the general doctrine propounded in this Paper cannot claim to be accepted as an established truth, until it shall have been tested by a vast number of observations, carefully carried out in various parts of the globe." It has now been so tested, to an extent that I could not then venture to anticipate ; and the results have proved in every particular so strikingly confirmatory of the views then advanced, that I feel justified in again bringing the subject before your notice, with the confidence derived from numerous accordances between *predictions* and *observed facts*, —such as are always admitted in philosophical reasoning to be the surest proofs of the truth of a hypothesis.

2. The General Doctrine—whose application to a number of cases having at first sight no relation to each other, is what I now propose to point out—is one of which every Physicist must admit the fundamental truth ; since it is one of the most elementary propositions in Physics, that, whenever the equilibrium of the several parts of a mass of liquid is disturbed, their inequality of pressure will produce a movement for its restoration.

To deny this in the case of water, is simply to deny that water is a liquid; its slight "viscosity" only *retarding* the restoration, not *preventing* it. But if the cause which disturbs the equilibrium should continue to act, there will always be a *tendency to restoration* without an *actual restoration*; and thus a continual movement of the different parts of the liquid will be sustained, so long as the disturbing cause remains in operation.

3. Let us, in the first place, take the simplest possible case of such a disturbance. Suppose a long narrow trough, A B, to be nearly filled with water, and a continued stream of air to be directed along it from one end, A, towards the other end, B; this will tend to carry the surface-water along with it, and, by *raising* the level at B, will *increase* the downward pressure of the column b C, whilst by *lowering* the level at A, it will *diminish* the downward pressure of the column a D. But this difference between the *downward* pressures of the columns of water at the two ends of the trough, will exert itself also in their *lateral* pressures; and thus there will be produced a *bottom-outflow* from the base of column b C, where the lateral pressure is *greater*, towards that of a D, where the lateral pressure is *less*. This outflow will *tend* to the restoration of equilibrium; but it will not *actually* restore it, if the current of air should continue to drive the surface-water from A towards B; for as fast as the surface of b C is lowered by the bottom-outflow, so fast will it be raised again by the surface wind-drift, and thus will be produced a *vertical circulation*, which will continue as long as the wind-current lasts.

DIAGRAM I.



4. Now this is a case of no unfrequent occurrence. It was pointed out by Sir William Thomson and Professor Stokes, in a discussion which took place on a paper I submitted to the Mathematical and Physical Section of the British Association in 1871,\* that when a strong wind continues to blow into a loch or long narrow inlet of

\* See 'Nature,' Aug. 17, 1871, p. 316.

the sea, the elevation or "head" of water it keeps up does not exceed a certain limit,—say 5 or 6 feet, notwithstanding that a strong surface-current is still flowing up the loch : the obvious explanation of which is, that the increase of vertical pressure puts in motion an outward under-current, which carries back the water the wind has driven in. The maintenance of this under-current depends upon the *constant renewal* of the disturbance of equilibrium produced by the constantly-renewed disturbance of surface-levels.—It is not requisite that there should be a complete obstacle to the onward movement of the wind-current; for an elevation of the surface-water, sufficient to produce by its downward pressure an under-current in the opposite direction, may be brought about by a partial obstruction. Thus in the Strait of Gibraltar, when an easterly wind meets the surface in-current (which I shall clearly prove to be an *evaporation-current*), it tends to raise a "head" in the Gut between Gibraltar and Tarifa ; and this reverses the ordinary direction of the under-current, making it flow back into the Mediterranean (§ 56). And in the Black Sea Straits, when the difference between the specific gravities of the Black Sea and Ægean columns is so far neutralised by a small elevation in the level of the former, that there is very little outflow, the effect of a strong wind setting down the Straits is to produce an outward surface-current, which, by lowering the level at their inner end, will enable the excess of density in the Ægean water (aided, perhaps, by some slight elevation of its level) to exert its effect in forcing back a strong under-current into the Black Sea (§ 63).

5. The same effect will obviously be produced by any other agency which increases the downward pressure of column b C, or diminishes that of a D. Thus if the *salinity* of the water at B be augmented by evaporation, which lowers the height of the column, while the salinity of the water at A is diminished, and its level raised, by an in-flow of an equal amount of fresh water; so soon as the levels of the two are equalised by the surface-flow from the higher towards the lower, the *downward* and therefore the *lateral* pressure of column b C will be in excess, and a bottom-flow will therefore take place from B to A, tending to restore the equilibrium. But if the surface-water which flows to B should undergo concentration in its turn, so that the excess of density in column B is maintained, whilst a constant in-flow of fresh water at the other end continues to reduce the downward pressure of column A, exactly the same *vertical circulation* will be maintained as in the preceding case.

6. We have an instance of this double agency in the production of the Black Sea currents. For whilst the salinity of the water of

the Black Sea is kept down by the excess of the supply of fresh water by rain and rivers over the loss by evaporation (§ 60), that of the Ægean is increased by the excess of evaporation in the Mediterranean basin, of which it forms part, over the return of fresh water (§ 45). But more commonly the disturbance is in one of the columns only—that of an Inland Sea—whilst the other remains at its normal level and density as a part of the great Ocean: this, however, does not alter the essential conditions of the case. Thus the constantly-maintained reduction in the salinity of the Baltic keeps up a constant disturbance of equilibrium between the Baltic column and the North Sea column (§ 70); though this may be occasionally neutralised by an elevation of level on the Baltic side, produced either by an excessive supply of fresh water, or by the opposition to the surface-outflow produced by wind. And in this way the ordinary under-current of the Baltic Sound may be brought to a stand, or may even be reversed. In the Red Sea, on the other hand, a constantly-renewed increase in the salinity of its water is occasioned by the enormous evaporation from its surface, which is uncompensated by any return of fresh water; the reduction of its level thus produced must draw in a strong evaporation-current through the Strait of Babel Mandeb, even though the surface wind-drift should be in the opposite direction (§ 29); while the excess of downward and therefore of lateral pressure exerted by the interior column over that of the Arabian Gulf outside, will produce an under-current, which, by carrying forth the excess of salt, prevents the basin from being filled up with a solid deposit, as it would otherwise be, in no great number of centuries (§ 28).

7. But it is further obvious, in the *third* place, that the same result will ensue if the Specific Gravity of column *b* C be *augmented* by a reduction of its Temperature, while that of column *a* D is *reduced* by an increase of its temperature; for the alteration thus produced in their relative *levels* being neutralized by a surface-flow from A to B, the column *b* C will become the heavier, and an under-current from B to A will be generated by its excess of lateral pressure. This bottom-outflow will renew the surface-inflow; and thus, so long as the water which is constantly entering the area near B is subjected, by the application of cold to its surface, to an increase of its specific gravity—whilst the water which returns towards A by the under-current is as constantly subjected to surface-heat, and thus has its specific gravity brought down again by the elevation of its temperature—so long will a *vertical circulation* be sustained, as in the preceding cases.

8. The *primum mobile* of this circulation is obviously the applica-

tion of *cold* at the *surface* of column *b C*; which produces exactly the same effect in making its water descend, as the application of *heat* at the *bottom* would have in making it ascend. The application of *heat* at the *surface* of the column *a D* has obviously no power of initiating such a circulation; for the heated water, being lighter than that below it, will continue to float; while the slight elevation produced by its expansion will only produce such a surface-flow from *A* towards *B*, as will serve to equalize their level. But, if not compensated by the continual restoration of heat at the opposite extremity of the trough, the continued application of cold would in time bring down the temperature of the whole mass of water it contains to an uniform level, and no further movement would then take place. Hence this restoration of heat keeps up the *difference* of specific gravities, and thus the disturbance of equilibrium is constantly renewed, producing a constantly renewed *nusus* towards its restoration, as I experimentally demonstrated to your Society on the former occasion on which I brought this subject before it. ('Proceedings' for January 9, 1871, p. 66.)

9. The application of this principle to the case of the great Oceanic Basin seems to render it a Physical necessity that a vertical circulation should be constantly sustained between the Polar and the Equatorial areas by the antagonism of their temperatures alone: — a *bottom out-flow* taking place from the Polar to the Equatorial area, while a *surface-indraught* from the Equatorial to the Polar area is maintained by the constant reduction of the level in the latter;—and a continual *downward* movement taking place in the Polar, and a continual *upward* movement in the Equatorial area.\* In carrying out this application, moreover, two things have to be borne in mind: *first*, that salt water continues to contract, and therefore to increase in density, down to its freezing-point at about 27° Fahr., instead of expanding, like fresh water, below 39°; and, *second*, that by the downward convection produced by evaporation (§ 36), the influence of heat applied to the surface of salt water will extend much deeper than it does in fresh water, so that the cold water rising from the bottom in the Equatorial area will be sooner brought under the influence of surface-heat, than it would be in a fresh-water basin.

10. The theoretical necessity for such a Thermal Circulation, under the conditions which we know to exist, appears so clear to myself, that I cannot understand how it can be denied by anyone who is

\* Since the above was written, I have had the satisfaction of learning that one of the most eminent Physicists and Mathematicians of his time propounded this doctrine nearly thirty years ago, in almost identical terms, as the *only possible rationale* of the facts he had established by observation (see §§ 82–84).

capable of grasping the very simple Physical conception it involves. The only question is, whether the excess of downward pressure in the Polar over the Equatorial column, which can now be determined on the basis of actual observation, is sufficient for its maintenance between bodies of water at the distance of from five to six thousand miles. To this question I shall address myself hereafter (APPENDIX II., § 137).

#### PART I.—INLAND SEAS.

As the information which we may draw from the Temperature and other Physical conditions of Inland Seas, and from the study of the currents of the Straits which connect them with the Oceanic area, will prove of great value in the investigation of the General Oceanic circulation, I shall give this subject the first place in our discussion.

11. Every Inland Sea is subject to two agencies, tending to alter both its level and its salinity:—namely, evaporation from its surface, by which its level will be reduced and its salinity increased; and a return of water by rain and rivers, by which its level will be raised and its salinity diminished. Now (as Sir William Thomson pointed out to me), it is a Physical improbability, almost amounting to an impossibility, that these two agencies should exactly balance one another, except in the cases of seas entirely shut in; in which they *come* to a balance by the alteration of the level, and by the consequent extension or contraction of the area, as will be presently shown to have been the case with the Caspian (§ 17). And I have the authority of the same distinguished Physicist for asserting, that wherever such inequality exists in the case of an Inland Sea connected by a Strait of sufficient depth with the Oceanic basin, there *must* be a double current:—namely, a *surface-current*, maintained by difference of *level*, and always tending to its equalization; and an *under-current*, maintained by difference of *specific gravity*, and always tending to the restoration of equilibrium; on the principle already explained (§ 5).

12. In the Red Sea, an enormous evaporation is constantly going on, almost entirely uncompensated by return either from rain or rivers; for the area of the Red Sea is nearly rainless, and scarcely any water comes from the land that encloses it. The rapid reduction of level which would hence ensue if the Red Sea were a closed lake, is prevented by the influx of sea water from the Arabian Gulf, which streams into it through the Strait of Babel Mandeb as a strong current running inwards through a large part of the year (§ 27) at the rate of from 30 to 40 miles per day.—In the Medi-

terranean, again, an enormous evaporation is constantly taking place, for which, as will be shown hereafter (§ 45), the return by rain and rivers is totally inadequate to compensate. And a nearly constant supply-current, modified by winds and tides, sets inwards through the Strait of Gibraltar.

13. In the Baltic, on the other hand, the loss by evaporation is far smaller than the return by rain and rivers (§ 69); so that its level would be raised, and its area increased, were it not for the outflow of the excess, which takes place through the Baltic Sound and the Great and Little Belt. And the same is the case in a less degree with the Black Sea, the overflow of which is carried off by the out-current which usually sets through the Bosphorus, the Sea of Marmora, and the Dardanelles, into the Ægean (§ 60).

14. In each of these cases, the inequality between the loss and the supply of fresh water is marked by an inequality between the salinity of the water *within* the Strait and that of the water *outside*. But this inequality remains, in each case, within a definite limit. It is obvious that as the place of the vast quantity of *fresh* water always passing off by evaporation from the Red Sea and Mediterranean, is taken by an influx of *salt* water, the quantity of salt in these basins must continually increase, unless it finds an exit by an under-current. Now, in neither case is there any evidence of such a progressive increase. The excess of specific gravity, as of level, remains practically constant; and there is no reason whatever to believe that any deposits of salt are going on upon the shores or bottoms of these basins. The existence of such an under-current in the Strait of Gibraltar, carrying out the denser water of the Mediterranean into the Atlantic, may now be considered as completely proved (§ 54); and there can be no reasonable doubt of the existence of that similar under-current in the Strait of Babel Mandeb, for which Captain Maury justly contended (§ 29).

15. On the other hand, the water of the Baltic and of the Black Sea is reduced in salinity by the excessive influx of river-water; so that the former averages about one-fifth, and the latter less than one-half, of the density of Ocean-water. Hence it is obvious that these basins would in time have their salt entirely washed out of them, if the quantity carried forth by the efflux of their weakly-saline water were not restored by an influx of strongly-saline Oceanic water. The existence of an inward under-current bringing the water of the German Ocean into the Baltic, as I showed in my former paper (p. 63), has long been known; and it has been since fully confirmed by the careful researches of Dr. Meyer (§ 71). In the case of the Black Sea, I affirmed that the existence of an inward

under-current "might be predicted on the double ground of *à priori* and *à posteriori* necessity;"\* and the truth of that prediction has lately been signally verified (§ 63).

#### CASPIAN SEA.

Before proceeding, however, to enquire in detail into the Physical conditions of these Inland Seas, and the agencies by which currents are sustained in the Straits that connect them with the general Oceanic Basin, it will be instructive to consider those which are presented by the largest Inland Sea that is entirely cut off from it; which were carefully examined, about twenty years since, by the distinguished Professor Von Baer. †

16. There can be no reasonable doubt that the Caspian Sea is a "survival" of that great Central Sea, which, at no remote geological period, covered a large part of Northern Asia; the gradual upheaval of the land having separated it from the Euxine on the one side, and from the Sea of Aral on the other, as well as from the Arctic Sea with which this marine province was formerly in communication. How small an elevation has sufficed to cut off this communication on the northern side, is shown by the fact that the connection of the Dwina with the Volga, by a system of canals, has opened a way for vessels to pass between the Caspian and the White Sea. Thus remaining isolated in the midst of land, the Caspian has undergone a series of very remarkable changes, which can be distinctly traced out.

17. In the first place, it is evident (as was long since pointed out by Pallas) that the former extent of the Caspian was much greater than its present area, which is estimated at about 180,000 square miles, or about the same as that of the Red Sea. The southern portion of its basin, which lies among mountains whose escarpments extend beneath the water, is by far the deepest; a large part of its bottom lying between 2000 and 3000 feet below the present surface of the water. The middle portion has also a considerable depth on the Caucasian side. But the northern portion is nowhere more than 50 feet deep; and this depth is continually being reduced by the alluvial deposits brought down by the rivers which discharge themselves into this part of the basin, notably the Volga and the Ural. These rivers run through an immense expanse of steppes, the slope of which towards the Caspian is almost impercep-

\* 'Proceedings of the Royal Society,' Dec. 8, 1870, p. 213.

† See his 'Kaspische Studien,' in the St. Petersb. Acad. Sci. Bull., 1855, 1856; and the summary given by Reclus in 'The Earth' (Woodward's translation), pp. 466 *et seq.*

tible; so that if the level of its water were to be raised, even very slightly, an expanse of land at least equal to its present area would be covered by it. Now as the present level is about 80 feet *below* that of the Black Sea, whilst ample evidence that the *steppes* were formerly overflowed by salt water is afforded by beds of marine shells, as well as by the persistence of numerous salt lakes and salt marshes, there can be no question that the northern basin of the Caspian formerly extended over the whole plain of the Volga below Saratov; and no other cause can be assigned for its contraction, than *the excess of evaporation over the return of water by rain and rivers.*

18. That when the basin of the Caspian had been once completely isolated, the level of its water was *rapidly* lowered by evaporation, until its area was so far reduced as to keep down the amount of evaporation to that of the return of fresh water by rain and rivers, is shown by Von Baer to be an almost inevitable inference from facts of two independent orders. At the height of from 65 to 80 feet above the present level, the rocks which formed the original sea-shore of the southern basin have been furrowed out into tooth-shaped points and needles; lower down, on the contrary, the rocks now laid bare show no trace of the erosive action of the water; so that its level would seem to have sunk too rapidly to allow the waves sufficient time to attack the cliff-walls effectively. A similar inference is drawn by Von Baer from the distribution of the channels with which the alluvial border of the northern basin is gashed.

19. *Present Equality between Evaporation and Return of fresh water.*—Since in the area of the Caspian, as at present limited, an *equality* has been established between the quantity of water lost by evaporation, and that returned to it by rain and rivers (for there is no reason to believe that any continuous change of level is *now* going on), we can arrive at a better idea of what the amount of such evaporation really is, from what is needed to make it good, than we have any other means of forming. The Volga is, next to the Danube, the largest European river, and its drainage-area is enormous; the Ural is a considerable river, probably not bringing down much less water than the Don; the Kuma, which drains the province of Stavropol, and the Terek, which brings down the water that descends from the northern slopes of the Caucasus, are probably together as large as the Dniester; whilst the Kur and the Araxes, which drain a large part of Transcaucasia, bringing down the water that descends the southern slopes of the Caucasus, cannot together be much inferior to the Dnieper: and yet the whole mass of water brought down by these six rivers, with that of many smaller

streams, serves only to keep the present level of the Caspian from being further lowered by evaporation.

20. *Temperature of the Caspian.*—In comparing the Evaporation of the Caspian with that of other areas of equal extent, its Temperature is, of course, the primary consideration. This is remarkable for its range, which, according to Keith Johnston, reaches *sixty* degrees. In summer this area lies, like that of the Mediterranean, between the isotherms of  $70^{\circ}$  and  $80^{\circ}$ ; but in winter the middle third of it lies between the isotherms of  $20^{\circ}$  and  $30^{\circ}$ , the northern basin being still colder, while the southern lies between the isotherms of  $30^{\circ}$  and  $40^{\circ}$ . Its *mean annual* temperature may be considered as about  $45^{\circ}$  at its northern end,  $55^{\circ}$  in its middle, and  $65^{\circ}$  at its southern extremity.\*

21. *Low Salinity of Caspian Water.*—It might have been expected that such a reduction in the volume of its water, as must have been produced by the *excess* of surface-evaporation over a very much larger area, in order to bring about the 80 feet reduction in the level of the Caspian, would have shown itself in an increase of its salinity; whereas the fact is, that the proportion of salt (which varies in different parts of the basin, and also at different seasons) is on the average only about *one-fourth* of that which is found in Oceanic water, and does not much exceed one-half of the proportion contained in the water of the Euxine. This reduction, however, is fully explained by the observations of Von Baer, who traces it to the number of shallow lagoons by which the basin is surrounded, every one of which is a sort of natural “salt pan” for the evaporation of the water and the deposit of its saline matter in the solid form. This process may be well studied in the neighbourhood of Novo-Petrosk on the eastern coast; where what was formerly a bay is now divided into a large number of basins, presenting every degree of saline concentration. One of these still occasionally receives water from the sea, and has deposited on its banks only a very thin layer of salt. A second, likewise full of water, has its bottom hidden by a thick crust of rose-coloured crystals like a pavement of marble. A third exhibits a compact mass of salt, in which are pools of water whose surface is more than a yard below the level of the sea. And a fourth has lost all its water by evaporation; and the stratum of salt left behind is now covered by sand. A similar concentration is taking place in the arm of the sea termed Karasu (black water), which runs southwards from the north-east angle of the basin; for notwithstanding the proximity of the mouths of

\* See the Maps to Buchan's 'Introductory Text-Book of Meteorology.'

the great rivers, the proportion of salt there rises so greatly above that of the ocean, that animal life, elsewhere extremely abundant, is almost or altogether suppressed.

22. *Evaporation-Current of the Karaboghz.*—This process goes on upon the greatest scale, however, in the Karaboghz,—a shallow *diverticulum* from the eastern part of the middle basin, which is probably a “survival” of the former communication between the Caspian and the Sea of Aral. This vast gulf communicates with the sea by a narrow mouth, which is not more than about 150 yards wide, and 5 feet deep; and through this channel a current runs inwards (*during summer*) with an average speed of three miles an hour. It is accelerated by westerly, and retarded by easterly winds; but it never flows with less rapidity than a mile and a half per hour. The navigators of the Caspian, and the Turkoman nomads who wander on its shores, struck with the constant and unswerving course of this current, have supposed that its waters pass down into a subterranean abyss (Karaboghz, black gulf), through which they reach either the Persian Gulf or the Black Sea,—a hypothesis which is at once negatived by the difference of level. The basin, being exposed to every wind and to most intense summer heat, is subject to the loss of an enormous quantity of water by evaporation; and as there is very little direct return by streams, the deficit can only be supplied by an inflow from the Caspian. The small depth of the bar seems to prevent the return of a counter current of denser water; none such having been detected, although the careful investigations made by Von Baer would have shown its presence if it really existed. And thus there is a progressively increasing concentration of the water within the basin of the Karaboghz; so that seals, which used to frequent it, are no longer found there, and its borders are entirely destitute of vegetation. Layers of salt are being deposited on the mud at the bottom; and the sounding-line, when scarcely out of the water, is covered with saline crystals. Taking the lowest estimates of the degree of saltiness of the Caspian water, the width and depth of the channel, and the speed of the current, Von Baer has shown that the Karaboghz alone daily receives from the Caspian the enormous quantity of *three hundred and fifty thousand tons of salt*. If such an elevation were to take place of the surface of the bar, as should separate the Karaboghz from the basin of the Caspian, it would quickly diminish in extent, its banks would be converted into immense fields of salt, and the sheet of water which might remain would be either converted into a shallow lake—like Lake Elton, which is 200 miles from the present northern border of the Caspian; or a salt marsh—like those

which cover extensive tracts of the steppes; or might altogether disappear by drying up,—as seems to have been the case with a depressed area lying between Lake Elton and the River Ural, which is 79 feet below the level of the Caspian, and about as much more below that of the Black Sea.—It is impossible that a more “pregnant instance” could be adduced, of the effect of *evaporation alone* in maintaining a powerful current, than is afforded by this case of the Karaboghzaz.

#### RED SEA.

23. *Physical Condition of the Red Sea.*—This remarkable basin lies in one of the hottest regions of the world. As it ranges between  $12\frac{1}{2}^{\circ}$  and  $30^{\circ}$  N. Lat., the greater part of its area falls between the Equator and the Tropic of Cancer: and thus from the vernal to the autumnal Equinox, the sun is nearly vertical over its southern half; whilst between the autumnal and the vernal, the declination only ranges from  $12\frac{1}{2}^{\circ}$  to  $36^{\circ}$  at Aden (which is the range of the *summer* months at Gibraltar), and from  $30^{\circ}$  to  $52\frac{1}{2}^{\circ}$  at Suez (about the range of the *summer* months at Berlin). Hence there is nowhere anything that can be called *winter*. But the constancy of its intense heat depends in great degree upon the fact that the solar rays stream down upon its surface during a large part of the year from an almost cloudless sky; and, further, upon the arid character of its shores, which, in the almost entire absence of rain, are not cooled by evaporation. There is, besides, some reason to suspect that heat is also supplied, in that southern portion of the sea which lies in an active volcanic region, from subterranean sources; the temperature of the water which issues from wells at Aden whose depth is from 97 to 257 feet, ranging from  $92^{\circ}$  to  $104^{\circ}$ .\* The ordinary range of air-temperature over the Red Sea area lies between  $70^{\circ}$  and  $94^{\circ}$ ; but the height of a thermometer hung in the shade gives no idea of the enormous heating power of the direct rays of the sun. I have been informed by Colonel Playfair, who was for some time British Consul at Aden, that he has seen a thermometer, with a blackened bulb, laid on a black board, and fully exposed to solar radiation, rise to  $215^{\circ}$  Fahr. The extreme dryness of this heated atmosphere is indicated by the great difference, often amounting to  $25^{\circ}$ , which ordinarily prevails between the wet- and dry-bulb thermometers; whilst during the Kam Sin, or hot wind of the desert, this difference rises to between  $30^{\circ}$  and

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\* Dr. Buist, in ‘Trans. of Geogr. Soc. of Bombay,’ 1859.

40°, so that drinking-water may be readily cooled down to a temperature at least 20° lower than that of the air.

24. The following averages of particulars respecting the surface-temperature of the Red Sea during each month in the year (except December, which are not given) are derived from the valuable body of observations tabulated by Dr. Buist,\* as having been obtained in three different years during steam-ship passages between Suez and Aden. Of the temperature during September Dr. Buist says:—"September gives us our greatest average heat, when both

	Number of Observations.	Maximum.	Minimum.	Average.
January .. .. ..	36	84	66	78°·7
February .. .. ..	25	83	70	78·8
March .. .. ..	46	85	74	81
April .. .. ..	38	86	70	81
May .. .. ..	46	90	70	82·7
June .. .. ..	14	91	78	85
July .. .. ..	24	92	78	84·5
August .. .. ..	24	90	81	86·5
September .. .. ..	39	96	78	88
October .. .. ..	31	92	76	83·1
November .. .. ..	33	88	76	83·4

sea and air get occasionally above blood-heat, with an amount of dampness that envelopes the body in one sheet of perspiration. Looking over the rails of the ship, with the sea in this state of heat, at a time when rain falls and cools the deck, the feeling conveyed is that of holding the head over a boiling caldron." Among the temperatures recorded by Dr. Buist, there are none so remarkable as those taken during the month of November, 1856; for the surface-temperatures of the sea on four consecutive days were 100°, 106°, 100°, and 96°; whilst the temperatures of the air on the same days were 80°, 82°, 83°, and 82°. If these observations were correct, it seems difficult to account for the extraordinary heating of the southern part of the basin which they indicate, on any other hypothesis than that of an unusual volcanic activity.

25. The average surface-temperatures taken by the steam-ships that cross between Aden and Bombay,† in that part of the Arabian Gulf which lies between the same parallels as the southern-third of the Red Sea, are no higher in the winter months than those of the Red Sea taken as a whole; while during the summer months

\* "Transactions of Bombay Geographical Society," 1859, pp. 31-41.  
 † Buist, *loc. cit.*

they are *from five to eight degrees lower*, the range between the extremes being also much less.

26. The average annual evaporation at Aden was estimated by Dr. Buist at only about 0·25 inch per day, or about *eight feet per annum*. But looking to the facts just stated in regard both to the elevated temperature and the depressed dew-point over the Red Sea area, it is clear that this estimate is much too low. For the actual evaporation at Marseilles is stated by Sir John Herschel, on the authority of Kämtz, at more than 85 Paris inches per annum; while MM. Régy and Vigan,\* who have carefully observed the amount of evaporation along the northern shores of the Mediterranean, state that during the summer months it is as much as 0·4 inch daily, which, if continued through the year, would be 12·3 feet. The annual evaporation at Aden is stated by Reclus † (though he does not give his authority) at *twenty-three feet per annum*, which would average about 0·75 inch per day; and I do not see any reason to regard this estimate as too high. Now the area of the Red Sea may be practically considered (like that of the Karaboghz, § 22) as one of *evaporation only*; the return of fresh water by rain or streams (rivers there are none) being so trivial and occasional that it may be thrown out of consideration. Consequently, if the Strait of Babel Mandeb were closed, the level of the Red Sea would be reduced at the rate of (say) *twenty-three feet per annum*; whereby, if we take the mean depth of the basin at 220 fathoms (Reclus), it would be entirely dried up in about sixty years.

27. *Red Sea Evaporation-Current*.—Hence, as the level of the Red Sea is maintained without any permanent change, it is obvious that, *without any other agency than that of Evaporation*, an average daily inflow *must* take place through the Strait of Babel Mandeb, which, on the estimate just quoted, would suffice to cover the whole area of the Red Sea (estimated at 180,000 square miles†) with a layer of water 0·75 inch thick. Now, this is equivalent to a layer of 35 feet in thickness, spread over an area of 320 square miles; and thus, if we take the average breadth of the Strait at 16 miles, a current occupying the whole of that breadth, and having a thickness of 35 feet, would need to flow at the rate of 20 miles per day, to bring in this body of water. But it is known that part of the Strait (as in the case of the Strait of Gibraltar) is always occupied by a current in the contrary direction; § so that if we assign to the

\* 'Annales des Ponts et Chaussées,' 1863 and 1869. † 'The Ocean,' p. 89.

† Capt. Barker, in 'Trans. Bomb. Geogr. Soc.' 1859, p. 13.

§ 'English Cyclopædia.' Geography: Art. "Red Sea."

in-current two-thirds of the breadth of the Strait, it would need to flow at the rate of 30 miles per day.

28. But this estimate, which is based only on the amount required to *keep up the level*, can be shown by a very simple calculation to be very far below the amount of the *actual* inflow determined by this enormous evaporation. For as all the water which thus passes off is *fresh*, while all the water which enters to replace it is *salt*, and as there is no reason whatever to believe that any accumulation of salt is taking place in the Red Sea basin, it is clear that *all the salt which is thus brought in must find its way out again*: for if it all remained, the Red Sea basin would in no long time become filled with solid salt (that time being, according to the low evaporation-estimate of Dr. Buist, less than 3000 years, and more probably between 2000 and 1500); whilst if only a part, however small, were retained, the salinity of the Red Sea water must be continually on the increase, which there is no reason whatever for supposing. The maintenance of the existing proportion, then, obviously requires that *all* the salt should be returned; and this can only be effected by an outflow of as much water as will carry it. Now, if the salinities of Oceanic and Red Sea water were equal, an accumulation of salt in the Red Sea basin could only be prevented by an outflow of exactly as much water as enters it. But since a comparison of their relative salinities (Forchhammer) gives their relative proportions as almost exactly 5 to 4, *four* measures of Red Sea water will contain as much salt as *five* measures of Oceanic water. And thus, assuming the quantity of salt in the Red Sea to remain stationary, for every *five* parts of water that enter, *four* parts must return, *only one* remaining to sustain the level. Hence, for the maintenance of that level, the in-current through the Strait of Babel Mandeb must have *five times the volume* just now estimated; or, assuming its breadth to be two-thirds that of the Strait, and its rate to be 30 miles per day, it must have a thickness of 175 feet, or nearly *thirty fathoms*.—Even taking Dr. Buist's low estimate of the amount of daily evaporation, the thickness of the current needed to replace it, if it have the rate and breadth just specified, and if four-fifths of it passes out again, would be 61 feet.

29. Hence it is clear that to whatever extent the movement of the *surface-water* in the Strait of Babel Mandeb may be modified by Winds, there must be a constant and rapid inflow dependent on *evaporation only*. And this becomes yet more obvious, when it is borne in mind that the wind-current flows *outward* during the months when the temperature is highest, and the evaporation

is consequently most rapid. That a sub-surface *in*-flow is not in the least inconsistent with a surface *out*-flow, is perfectly well known to every one who has seen the meeting between a strong wind and a rising tide; for though the action of the wind may reverse the direction of the surface-current, yet it cannot prevent the sub-surface inflow, though it may somewhat retard and diminish it (see § 66). Although it is possible that the surface out-current sustained by wind may (while it lasts) carry forth the four-fifths of the evaporation inflow which have been shown to be in excess, yet this seems scarcely probable, especially when it is borne in mind that there is a surface in-current on the other side of the Strait (Barker, *loc. cit.*). And when the wind-current concurs with the inflow, which is the case during the cooler months, it is obvious that there cannot be any other escape for the excess (save by the small surface counter-current), than by means of an under-current; the existence of which Captain Maury was fully justified in predicating as necessary to carry back the salt which would otherwise accumulate, whilst he found a *vera causa* for its maintenance in the excess of Specific Gravity constantly kept up by evaporation in the Red Sea column.\*

30. It is a curious fact that it is during the cooler season, when the N.E. monsoon causes a strong westerly set into the funnel-shaped Gulf of Aden, and thence through the Strait into the Red Sea, and when evaporation is at its least, that the level of the Red Sea is at its lowest, as is shown by the exposure of the coral-banks.† This apparent anomaly may be so readily explained upon the principle already set forth (§ 3), as to be in fact a remarkable exemplification of it. The narrowing of the Gulf will cause a "head" of water to accumulate on the outside of the Strait; and, this, producing an under-current in the opposite direction, will tend to increase, as by a *vis à fronte*, the under-current which carries out the dense water of the Red Sea, and thus to lower its level.

\* See his 'Physical Geography of the Sea,' § 375.—It follows from the above that *exclusive* advocates of Wind-Currents, like Mr. Laughton ('Physical Geography,' p. 245), are quite beside the mark in treating the existence of an evaporation-inflow through the Strait of Babel Mandeb as "theoretical," on the ground that observation proves that the direction of the surface-current changes with that of the wind. It is just as certain that an enormous inflow *must constantly* take place into the Red Sea, to supply its loss of water by evaporation, as that such an inflow *does* take place into the Karaboghzaz (§ 22); and in speaking of "the winter" as a time when "the evaporation is feeble," Mr. Laughton entirely ignores the fact that the *winter*-evaporation of the Red Sea cannot be less, over equal areas, than the *summer*-evaporation of the Caspian, which suffices to get rid of the entire mass of water that is brought down by its great rivers when they are swollen by the melting of the snows.

† Schweinfurth, in Petermann's 'Mittheilungen,' 1868.

An example of the like action, encountered by myself in the Strait of Gibraltar, will be presently mentioned (§ 56).

31. *Animal Life of Red Sea.*—There are certain points in the Physical Geography of the Red Sea basin, which must greatly affect its relation to Animal life. In the first place, as its deeper portion is shut off, like that of the Mediterranean, from the deeper part of the Oceanic basin, by the shallowness of its connecting Strait, the temperature of all that lies below the variable superficial stratum may be expected to be uniform and constant. This is just what Captain Pullen's soundings indicate; for he found that, while the temperature continued to diminish from the surface downwards as far as 200 fathoms, the thermometer there became stationary at  $70^{\circ}$  or  $71^{\circ}$ , and continued so to the bottom at 678 fathoms. And that this temperature is the *isocheimal* (or mean winter temperature) of the locality, appears from the fact that Captain Nares found the temperature of the Gulf of Suez, in the month of February, to be  $71^{\circ}$  from the surface to the bottom at 450 fathoms. Hence, as in the Mediterranean (§ 39), there must be an absence of any *thermal* or *vertical* circulation, except that which is produced by the downward movement of the films concentrated by surface-evaporation (§ 36); and thus there will be a stagnation in the deeper water of the basin, unfavourable to the existence of Animal life. But this stagnation will probably not be by any means as complete in the Red Sea, as it is in the Mediterranean; since the depth of the former is so much less, that the influence of the tides and wind-currents, as well as the interchange through the Strait, will extend much nearer its bottom. Moreover, the Red Sea differs essentially from the Mediterranean, in not being the recipient of any great rivers bringing down sedimentary matter from the land. This difference, of course, affects the condition of the bottom, on which we do not find the fine abundant sedimentary deposit that is everywhere settling down in the abyssal depths of the Mediterranean (§ 39); and it will also leave the bottom-water clear; so that in these respects the condition of the bed of the Red Sea will be more favourable to Animal life than that of the Mediterranean. But the absence of *organic* sediment—if the views to be presently considered be correct—will constitute a still more important difference between the conditions of the two Seas in relation to Animal life; for while its progressive decomposition in the abyssal waters of the Mediterranean consumes its oxygen and imparts to it carbonic acid, at a greater rate than “diffusion” can counterbalance without any vertical circulation in the water itself, and thus tends to render the

depths of that sea uninhabitable (§ 41), the absence of the like source of impurity in the water of the Red Sea may be expected to leave its abyssal water in a condition fit to support a moderate amount of Animal life; since the process of diffusion, even without vertical circulation, will maintain a certain amount of interchange of gases between the superficial and the deep strata.

32. The possible influence of the uniformly-elevated Temperature in the Red Sea, upon the growth of the Corals which abound in its basin and form the reefs so dangerous to the navigator, constitutes another question of great interest. It seems to be the universal opinion of those who have most carefully studied the existing Coral formations in the Oceanic area, that the reef-building types do not live and grow at a greater depth than the twenty fathoms first assigned as their limit by Mr. Darwin. Yet since stony Corals, similar to these in every physiological character save massiveness, have been repeatedly brought up in the 'Porcupine' and 'Challenger' dredgings from depths of *several hundred* fathoms, there seems no *a priori* reason for the restriction of the reef-builders to this limited depth; and it has suggested itself to me, whether the limit is not really one of *temperature*. For it is pointed out by Mr. Dana in his recent treatise on 'Corals and Coral-Islands,' as a deduction from the Geographical distribution of the Reef-builders, that they cannot live in any part of the Ocean of which the temperature ever falls below 68°; so that even the Galapagos Islands, which lie under the Equator, are outside the boundary-line of the Coral Sea; this line being carried to the north of the Equator by the cold (Humboldt's) current, which comes up along the western coast of South America, and which I regard as the *indraught* of the Pacific Equatorial current. Now all we at present know of the relation of Temperature to Depth would indicate that in the Intertropical area of the open ocean (§ 95), the temperature at twenty fathoms is not much above 68°, and that in the next ten fathoms it suffers a considerable reduction; so that the *bathymetrical* limit of the reef-builders may really be a *thermal* one. And since the Temperature of the Red Sea at all depths, and throughout the year, seems to be above that limit, it will become a most interesting question to determine whether the Reef-building Corals are, or are not, to be found in that sea at a greater depth than in the open Ocean; and, if so, what is the greatest depth at which they there exist. This question has obviously a most important bearing on the interpretation of many Geological phenomena; for if the limitation of the depth of living reef-builders be really *thermometric*, instead of *bathymetric*,—so that, when secluded from the general Oceanic Circu-

lation, they can grow up from a greater depth than in the Oceanic area,—it is obvious that such a limitation cannot be rightly assumed in regard to the Coral growths of former epochs, unless we know the conditions under which they have been formed.

#### MEDITERRANEAN SEA.

33. *Physical Geography of the Mediterranean.*—This greatest of Inland Seas may be regarded as almost Oceanic, in respect alike of the vastness of its area, and of its enormous depth. Its surface (including the Adriatic and the *Ægean*) is about 970,000 miles, and its average depth is probably not less than 1200 fathoms. The Mediterranean proper consists of two very deep basins:—the Western, which extends from the Strait of Gibraltar to the Adventure and Skerki Banks that connect Sicily with the coast of Tunis, having a depth which ranges, over a large part of its area, between 1000 and 1600 fathoms; whilst the Eastern, which extends from Malta and the eastern coast of Sicily to the Levant, is yet deeper, its bottom having in some parts a depth of more than 2000 fathoms. The shallow area which completely separates all but the superficial portions of these two basins, has scarcely anywhere a greater depth than 200 fathoms; while the Strait of Gibraltar, which constitutes the sole channel of communication between the Mediterranean basin and the outside Atlantic, and which has a depth of about 500 fathoms between Gibraltar and Ceuta, gradually shallows, as it widens, towards its western *embouchure* between Capes Trafalgar and Spartel, where there is a “ridge,” or “submarine watershed,” of which the average depth is about 120 fathoms, certain passages across it approaching 200 fathoms in depth. Hence a general elevation of the Mediterranean area to the extent of a little more than 200 fathoms, would have the effect of not only cutting it off entirely from the Atlantic, but also of dividing it into two great salt Lakes, each of which, without any great reduction of area, would still be enormously deep. The Eastern basin lies between the parallels of  $31^{\circ}$  and  $36^{\circ}$ ; the Western for the most part between those of  $36^{\circ}$  and  $44^{\circ}$ . The summer Isotherm of  $80^{\circ}$  lies a little to the south of the whole African coast-line, turns northward round the Levant, and then follows the eastern coast of the *Ægean* and the southern shore of the Black Sea, crossing the southern basin of the Caspian in its course eastward. Even the northernmost portions of the basin scarcely lie outside the summer Isotherm of  $75^{\circ}$ ; so that we may consider the whole of it as subject to a summer temperature of from  $75^{\circ}$  to  $80^{\circ}$ . The winter Isotherm of  $50^{\circ}$  passes along the axis of the basin; and while along its southern shores the winter air

temperature averages  $55^{\circ}$ , it ranges along the northern as low as  $40^{\circ}$ , or even lower.

34. *Surface-Temperature.*—These Isotherms, however, are deduced from air-temperatures, and do not indicate the temperature of the water, which is rather lower in summer, but (over a greater part of the basin) considerably higher in winter, than those Isotherms would indicate. I have myself seen it ranging in each basin, during the months of August and September, between  $73^{\circ}$  and  $79^{\circ}$ ; while, during the months of January and February, it is about  $56^{\circ}$  at Algiers, and nearly  $54^{\circ}$  at Toulon. That this elevation of sea above air-temperature is not due (as some have supposed) to the entrance of Gulf-stream water through the Strait of Gibraltar, but belongs to the Mediterranean itself, will appear not only from the facts to be presently stated in regard to the peculiarity of its Thermal condition, but also from this, that the water of the Gibraltar in-current is derived from a sub-surface stratum having a much lower temperature than that of the surface-water of the Atlantic from which it is drawn (§ 57).

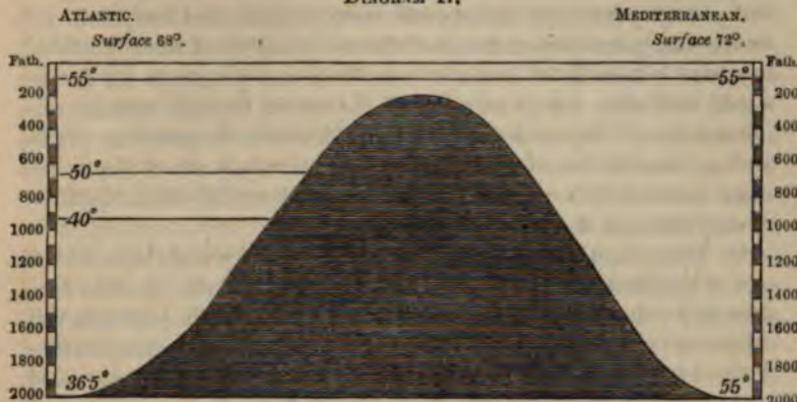
35. *Uniform Sub-surface Temperature.*—The high *summer*-temperature of the surface of the Mediterranean is limited to a very thin stratum, and then gives place (as D'Urville and Aimé\* first pointed out) to a uniform temperature, which extends downwards to the bottom. In the Western basin the thermometer generally sinks at 50 fathoms to  $55^{\circ}$  or  $56^{\circ}$ ; and below this we observe very little change down to 100 fathoms, at which depth it usually stands at  $54^{\circ}$  or  $55^{\circ}$ . From this to the bottom, however deep that bottom may be, the temperature continues constant; the water between 100 and 1600 fathoms having absolutely the same temperature of  $54^{\circ}$  or  $55^{\circ}$  throughout. In the Eastern basin, of which the axis lies about  $2^{\circ}$  further to the south, the heat of the superficial stratum extends somewhat further down; but the uniform temperature is always reached at less than 200 fathoms; and from that depth to the bottom at (it may be) 2000 fathoms, the temperature of  $56^{\circ}$  is found everywhere to prevail. In *winter*, on the other hand, the temperature is uniform, or nearly so, *from the surface to the bottom*. This condition differs completely from that which prevails in the Oceanic area generally; and contrasts especially with that which we find in the Atlantic at similar depths. For there, after passing through the superheated stratum, we find the thermometer descending with the depth, though by no means at a uniform rate (§ 88), until it reaches  $36\frac{1}{2}^{\circ}$ .—The question forces itself upon us,

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\* 'Annales de Chimie,' tom. xv. (1845) pp. 5-34.

therefore, to what this difference (represented in Diagram II.) is to be attributed.

DIAGRAM II.



36. It is perfectly obvious, in the first place, that the influence of direct Solar heat is limited to that superficial stratum whose temperature varies with the season; and, secondly, that below this stratum, in the Mediterranean basin, depth *per se* exerts no influence whatever. It is, moreover, pretty certain that the sun's calorific power is not exerted so much by the direct penetration of its heat-rays, as by a process of *downward convection*, which can only be carried on in salt water; the surface-films, as they are concentrated by evaporation, descending through the subjacent stratum, and communicating to it their excess of heat and of salt, while they are successively replaced by films of less saline water which come up from below. If this downward convection be constant, as it is in Tropical seas, the influence of surface-heat will extend much deeper than it does in the Mediterranean; where, every six months, the downward convection of Heat is neutralised by a downward convection of Cold. But why should the constant temperature of the whole mass of water beneath 100 fathoms lie between 54° and 56°? and why should the superficial stratum, whose temperature in summer ranges to at least 20° higher, have a winter temperature which is the same as that of the deep water it overlies?

37. In my Report to the Royal Society of my first researches in the Mediterranean, I regarded the uniform temperature of its deeper water as representing the *subjacent* influence of the warm crust of the Earth; the temperature of which in the Mediterranean area, as indicated by the uniform temperature of a deep cave in the island of Pantellaria, and by that of the deepest tanks in Malta, seems to be 54°.

But I have come to believe that this coincidence is accidental only : and that, the deep cold water outside being excluded, the uniform temperature of the mass of Mediterranean water in each basin must really correspond to its *lowest winter mean*, or *isocheimal* temperature.\* As the sun gains power, it raises the temperature of the superficial stratum ; but even its summer heat does not penetrate far downwards, and thus the great mass of the water beneath remains unaffected by it. If, on the other hand, the winter-temperature of the surface were to be reduced, that reduction would affect the entire mass ; because the surface-water, when cooled, would sink and diffuse its cold through the water beneath.†

38. Thus, then, although the mean *air-temperature* of the northern part of the Mediterranean basin falls during the winter months considerably below  $50^{\circ}$ , yet the great depth of that basin prevents this reduction from having any considerable effect upon the temperature of the vast mass of water beneath : for as fast as a slightly-cooled surface-film descends, it will be replaced from the warm stratum beneath ; and since whatever heat is thus withdrawn from the latter during the winter, is fully replaced during the summer in the manner just described, the uniform temperature of the basin is scarcely at all disturbed. But, further, the elevation of the winter *sea-temperature above* the mean winter *air-temperature* of the northern shores of the Mediterranean, will produce exactly that effect upon *their* climate, which the afflux of warm water to the coast of Norway produces upon *its* climate (§ 112). And it is to this that the peculiar mildness of such places as Hyères, Cannes, and Mentone, seems in great part due.

39. *Consequences of Absence of Thermal Circulation.*—But the entire absence of thermal circulation in the deeper parts of this vast basin, which is the necessary consequence of the uniformity of its temperature, has a most important effect upon those conditions which determine its capacity for supporting Animal life. When I first visited the Mediterranean, I fully expected to find its depths tenanted by the like varied and abundant Fauna that we had met with at

\* I now find that this doctrine was originally propounded by Aimé, on the basis of the observations just referred to.

† I learn from Mr. Buchan, the able Secretary of the Scottish Meteorological Society, that the deepest parts of Loch Lomond have been found to present a uniform temperature of  $41^{\circ}$ , which is also the *isocheimal* of the locality.—In freshwater Lakes, as Saussure long since found, the lowering of the *isocheimal* beneath  $39^{\circ}$  does not depress the temperature of the deep water below that of its greatest density ; whilst in the Polar marine areas, the increase of density which salt water undergoes in being cooled down to its freezing point, will allow of the reduction of deep temperature by surface-cold down to  $27^{\circ}$  or even (perhaps) to  $25^{\circ}$ . (See § 78.)

corresponding depths in the Atlantic; and considering that the existence of this Sea can be clearly traced back through the whole Tertiary period, I expected to find in this Fauna the like representation of the early Tertiaries, that the Fauna of the deep Atlantic had shown of the Cretaceous. What, then, was my disappointment at finding the dredge come up, time after time, from depths ranging between 300 and 1500 fathoms, laden with a barren mud, the most careful examination of which revealed not a single living organism, and only a few fragments of dead shells and corals, large enough to be recognisable as such, which had obviously drifted from some other locality. The idea of the nearly *azotic* condition of the deeper part of the Mediterranean, to which I was thus led, having been confirmed by the results of Oscar Schmidt's dredgings in the Adriatic, the question arises—to what is this condition due? I was in the first instance disposed to attribute it to the turbid condition of the bottom-water, which is charged (as I was able to prove by observation) with extremely fine sedimentary particles, whose slow settling-down forms the mud of the bottom. These seem to be chiefly derived in the Eastern basin from the Nile, and in the Western basin from the Rhone: the coarser particles in each case settling down near the mouths of those rivers, whilst the finer are diffused through the whole mass of Mediterranean water, gravitating very slowly to the depths of its basin.\*

40. It is well known that a muddy state of the bottom-water is unfavourable to the presence of Animal life; and it has been particularly noted by Dana, † that where such a sediment brought down by a current is diffused over a part of a bed of living Coral, it kills the animals of that part. Moreover, I learned at Malta that in the beds which yield the extremely *fine-grained* stone which is used for delicate carvings, scarcely any Fossils are found, save sharks' teeth; whilst in the *coarse-grained* beds of the same formation, fossils are abundant: and as the former may be regarded as the product of a slow deposit in the *deep sea*, so may the latter be considered as *shore-beds*. Further, I have been informed by Professor Duncan, that in the Fleisch of the Alps, which shows in some parts a thickness of several thousand feet, and which is composed of a very

\* It may be interesting to note, that it is to this diffusion,—experimentally proved on the large scale by the admixture of mud with the saline deposit of the boilers of steam-ships voyaging in the Mediterranean, and on the small by Professor Tyndall's electric-light test,—that the peculiar *blueness* of the waters of the Mediterranean is due. The case is precisely paralleled by that of the Lake of Geneva, through which the Upper Rhone flows, depositing near its entrance the coarser particles of sediment, and diffusing the finer through the entire water of the lake, to which they impart a corresponding blueness.

† 'Corals and Coral Islands,' p. 121.

fine sedimentary material, there is an almost entire absence of Organic Remains.

41. But in studying the conditions of the Thermal Circulation of the great Oceanic basins, I came to see that there is another condition of the bottom-water of the Mediterranean, which is not less unfavourable than its turbidity—probably more so—to the existence of Animal life in its depths; namely, the *deficiency of Oxygen*, produced by the slow decomposition of the Organic matter brought down by its great rivers. According to the determination which I made in my second visit to the Mediterranean in 1871, the gases boiled-off from water brought up from great depths contained only about 5 per cent. of Oxygen and 35 per cent. of Nitrogen, the remaining 60 per cent. being Carbonic acid. Now in gases boiled-off from the deep water of the Atlantic, the average percentage of Oxygen was about 20, while that of Carbonic acid was between 30 and 40; even this large proportion of Carbonic acid not appearing prejudicial to the life of the marine Invertebrata, so long as Oxygen was present in sufficient proportion.

42. The *rationale* of both these conditions seems obviously the same;—namely, that in consequence of the uniformity of temperature of the whole mass of Mediterranean water below the surface-stratum of 200 fathoms (which alone will be disturbed by wind, or be affected by the influx of rivers and of the Gibraltar current), there is *no thermal circulation*; the whole contents of the deeper part of this immense basin being thus in an *absolutely stagnant* condition. If the doctrine of a vertical Oceanic Circulation be true, every drop of Ocean-water is brought in its turn to the surface, where it can get rid of its carbonic acid, and take in a fresh supply of oxygen. But as the density of the surface-stratum of the Mediterranean is never rendered greater by reduction of temperature, than that of the mass of water it overlies, there is no agency capable of producing any interchange: the bottom-water charged with the slowly-gravitating sediment is never disturbed; and the Organic matter contained in that sediment consumes its Oxygen so much more rapidly than it can be supplied from above by diffusion through the vast column of superincumbent water, that nearly the whole of it is converted into Carbonic acid, scarcely any being left for the support of Animal life.

43. These considerations, then, seem fully adequate to account for the paucity of life in the deeper part of the Mediterranean basin; and they will, of course, equally apply to the case of any other Inland Sea, so far as the same conditions apply (§ 41). And it is not a little interesting to find that my old friend and fellow-student

Edward Forbes was perfectly correct as to the limitation of Animal life—so far as regards the Ægean Sea, in which his own researches were prosecuted—to a depth of about 300 fathoms; the error, which was rather that of others than his own, being in the supposition that this limitation applies equally to the great Ocean-basins, past as well as present. The researches in which it has been my privilege to bear a part, have shown that *as regards the latter* there is probably *no* Bathymetrical limit to Animal life; while the results of my inquiries into the influence of the Physical conditions of the Mediterranean, in limiting the Bathymetrical diffusion of its Fauna, will not, I venture to hope, be without their use in Geological theory.

44. *Relation of Evaporation to Rainfall and River-supply.*—Although for an *exact* estimate of the amount of evaporation over the Mediterranean area, materials are still wanting, yet there is ample reason for the confident assurance that it must enormously exceed the amount of fresh water returned into its basin by rain and rivers; so that if, by a rise of the ridge at the western entrance of the Strait of Gibraltar, it were to be separated from the Atlantic, and converted into a completely land-locked inland sea, as the Caspian has been (§ 17), its level would undergo a progressive reduction by excess of evaporation, until, by the reduction thus occasioned in its area, an equality should come to be established between the loss and the return.

45. Putting aside as altogether unsatisfactory the old estimate of Dr. Halley, who first suggested the excess of Evaporation as the *rationale* of the Gibraltar in-current, we find Sir John Herschel estimating the annual evaporation from the whole surface (including that of the Euxine and the Sea of Azov) at 50 inches; at the same time remarking that this is certainly quite within the truth, as the *observed* annual evaporation at Marseilles exceeds 85 (Paris) inches. The annual restoration by rainfall at Palermo, which may be considered from its position as a fair sample of the whole, is 22.3 inches; and this accords almost exactly with the average of 23 inches obtained from eleven stations at points surrounding the whole of the Mediterranean, as reported by Admiral Smyth. Thus there is an *annual deficit* of 27.7 inches, which, spread over the whole area, would make 508 cubic miles of fresh water to be supplied by rivers. Now, the Nile is estimated to contribute  $21\frac{2}{3}$  cubic miles annually; so that to supply this deficit, 23 Niles would be needed. Thus, even on the extravagant supposition that each of the other principal rivers (the Danube, Dnieper, Don, Rhone, Dneister, Ebro, and Po) contributes as much as the Nile, we should still have only

173 cubic miles of river-supply, leaving 335 to be furnished by the Atlantic.\*

46. The more recent estimate of two French officers, MM. Régéy and Vigan,† who have compared the probable evaporation of the Mediterranean proper (excluding the Euxine) with the rainfall over its area, makes the *deficit* 54 inches, or nearly double Sir John Herschel's estimate for the wider area. This exclusion of the Black Sea and its rivers makes the case much stronger; for, as will be presently shown, these rivers contribute scarcely any water to the Mediterranean (§ 60); so that there are no other great rivers left to supply this enormous *deficit*, than the Nile, the Rhone, and the Ebro, which would not, taken altogether, furnish a tenth part of it.

47. I have shown ('Contemporary Review,' 1873) that the like conclusion may be reached without any estimate of the actual amount of evaporation, by a comparison of the conditions of the Caspian and the Mediterranean basins. The area of the Mediterranean proper (including the Ægean and the Adriatic, but excluding the Euxine) is more than *five* times that of the Caspian; and, looking to the comparatively high winter temperature of the Mediterranean, and to the degree in which it is subject to the hot, dry winds of the Libyan Desert,‡ we should certainly be within the mark in estimating its annual evaporation at *six* times that of the Caspian. To compensate for this evaporation, therefore, six times the amount of return of fresh water by rain and rivers will be required; and as there is no reason to believe that the *rainfall* over the Mediterranean area is greater in proportion than it is over the Caspian, the *river-supply* must be at least six times as great to make up the *deficit*. Yet to set against *six times the sum* of the great Caspian Rivers (§ 19), we have only one Nile, one Rhone, one Po, and one Ebro, with a small contribution from the Black Sea rivers and from some submarine springs.

48. It is difficult to understand how, in the face of this evidence, there can be any kind of doubt that an enormous inflow of water *must* take place from the Atlantic, through the Strait of Gibraltar, to keep up the present level of the Mediterranean. (See APPENDIX I.) The only real argument that has been brought against it, is that the Gibraltar current continues to flow during winter. But

\* Sir J. Herschel's 'Physical Geography,' p. 27.

† 'Annales des Ponts et Chaussées,' 1833 and 1866.

‡ The extreme *dryness* of the hot winds which often blow across the Mediterranean from the Libyan Desert, must greatly increase the evaporation. The *siroque* of Malta is as oppressive from its dampness, as the *sirocco* of the Desert is parching from its dryness.

this objection disappears when it is remembered that the winter air-temperature averages at least  $50^{\circ}$  over the whole basin, and that the surface-temperature of the water averages  $55^{\circ}$ , whilst, on the other hand, the great rivers are then at their lowest. It is during the latter part of the summer, when the rise of the Nile takes place, and the melting of Alpine snow and ice feeds the Rhone, that the rivers make their largest contribution to the replacement of the water lost by evaporation.

49. *Further Observations on the Gibraltar Currents.*—Although the results of the conjoint inquiries which had been made by Captain Calver and myself in the 'Porcupine' Expedition of 1870, seemed to us to leave no reasonable doubt as to the existence of an outward under-current in the Strait of Gibraltar, yet we both felt extremely desirous that the matter should be more thoroughly examined; for we were fully conscious that the proof could not be regarded as complete, until direct *mechanical* evidence should be obtained by the "current-drag," of the passage of Mediterranean water over the "ridge" or "marine watershed" between Capes Trafalgar and Spartel, which forms the proper boundary of the Mediterranean basin,—the evidence we had obtained of such passage being *inferential*, and therefore open to objection. And as we saw, in addition, that the rate, perhaps even the direction, of this under-current was liable to variation under the influence of winds and tides, we felt that the subject could not be fully elucidated without a far more prolonged and systematic study of its phenomena than it was in our power to carry out. I had therefore much satisfaction in availing myself of the opportunity afforded me by the Hydrographer to the Admiralty, for co-operating with Captain Nares of H.M. Surveying-ship 'Shearwater' (then on her way to complete the survey of the Gulf of Suez) in the re-investigation of the Gibraltar Currents.

50. The inquiries made in the 'Porcupine' Expedition of 1870 having shown that the information obtainable by the Hydrometer respecting the *stratification* of Atlantic and Mediterranean waters in the Strait of Gibraltar might afford valuable evidence in regard to their *movement*, I made the determination of Specific Gravities my own special charge; whilst Captain Nares, in consultation with me, carried out the mechanical portion of the investigation. I shall here give only the general results of our joint inquiries, the details of which will be found in the 'Proceedings of the Royal Society' (January 18, and June 13, 1872).

51. The depth of the northern half of the channel over the western "ridge" scarcely anywhere exceeds 50 fathoms; whilst

in its southern half the depth does not seem anywhere to reach 200, and may be considered to average 150 fathoms. From this "ridge" the Atlantic slope deepens gradually westwards, until, at a distance of about 45 miles, a depth of from 500 to 600 fathoms is reached. On the other hand, the Mediterranean slope deepens gradually eastwards along the whole length of the Strait (about 35 miles), as far as its *embouchure* in the Mediterranean between Gibraltar and Ceuta, where the depth of the deepest part of the channel exceeds 500 fathoms. Thus it appears that the Strait is to be considered as a prolongation of the Mediterranean basin, not of that of the Atlantic. If its bottom were to be elevated 200 fathoms, the "ridge" would become dry land, entirely cutting off the Mediterranean from the Atlantic; but though the channel between the European and African shores would be considerably narrowed, it would still extend further west than Tangier. If thus completely cut off from the Atlantic, the Strait would be in every sense a part of the Mediterranean, and would be entirely filled with the denser water of that great inland sea. But in virtue of its communication with the Ocean outside, and of the continual inflow (modified by tidal changes) of a surface-current from the Atlantic, the whole *upper* stratum of the water of the Strait has a purely Atlantic character, which is as distinctly recognizable by the specific gravity test at the Mediterranean, as it is at the Atlantic end of the channel. On the other hand, the *lower* stratum no less distinctly corresponds in specific gravity with the denser water of the Mediterranean; so that its presence can be recognised by this character no less certainly on the summit of the "ridge," than in the deepest portion of the Mediterranean embouchure.

52. I made it, therefore, my first object to ascertain whether the presence of Mediterranean water could be detected by an excess in the specific gravity of the *bottom*-water, on the *Atlantic* side of the slope; our previous inquiries having shown that the ordinary *bottom*-water of the Atlantic, which we now know to be Polar (§ 96) has a *lower* salinity than its *surface*-water. Beginning at a station in Lat.  $36^{\circ} 47' N.$ , and Long.  $9^{\circ} 39' W.$ , about 45 miles W.S.W. of Cape St. Vincent, we found the specific gravity of the *surface*-water to be 1.0268, and that of the *bottom*-water at 1560 fathoms' depth to be 1.0281. A like marked excess in the specific gravity of the *bottom*-water over that of the *surface*-water was noted in a succession of soundings taken between the preceding and the "ridge;" the excess increasing as the "ridge" was approached, so that at about 20 miles to the westward of it, the specific gravity of the *surface*-water being 1.0270, that of the *bottom*-water at 325 fathoms was 1.0285. It

was thus clear that the Mediterranean water was flowing down the *Atlantic* slope of the "ridge." On the ridge itself we found the specific gravity of the *surface*-water to be 1·0271, and that of the *bottom*-water at 125 fathoms to be 1·0292; and as the former was clearly Atlantic water, and the latter Mediterranean, we set ourselves to determine the relative depth of each stratum. We found that at 50 fathoms the specific gravity had increased to 1·0273, and that at 100 fathoms the specific gravity showed a further increase to 1·0276; but that a marked increase from this to 1·0290 showed itself between 100 and 110 fathoms; so that while the lower part of the Atlantic stratum showed a sufficient admixture of Mediterranean water to affect very sensibly its specific gravity, the stratum below 110 fathoms might be considered as consisting essentially of Mediterranean water. Proceeding within the Strait, we found that, off Tarifa, a sample of water taken from the *bottom* at 330 fathoms gave the high specific gravity of 1·0293; clearly showing its Mediterranean character. Samples taken at depths of 200 and 150 fathoms gave almost exactly the same specific gravity; as did also a second pair of samples taken in nearly the same part of the Strait at 150 fathoms and 125 fathoms. As the Strait deepened, however, towards Gibraltar, we found the stratum of Mediterranean water lying at a greater and greater depth beneath the surface; our specific gravity observations taken between Gibraltar and Ceuta, where the depth was between 450 and 500 fathoms, concurring with those of the previous year in indicating that Atlantic water extends downwards to between 200 and 225 fathoms, whilst from 250 fathoms to the bottom, the channel is filled with Mediterranean water.

53. Thus while the stratum of Mediterranean water, from Tarifa to the "ridge," lay at between 100 and 125 fathoms from the surface, it lay between Tarifa and Gibraltar at a depth increasing to between 200 and 250 fathoms; in other words, between the Mediterranean end of the Strait and Tarifa it rose at least 100 fathoms nearer the surface. It was clear from observations made on the "ridge" through the whole succession of tidal changes, that it is constantly covered by a stratum of Mediterranean water: whilst our previous observations show that this water flows down the Atlantic slope. Hence it seems clear that it is acted on by an impelling force sufficiently strong to cause it run *up-hill*, just as the heavier because colder water has been found to do in the Florida Channel (§ 148). As the distance between Gibraltar and Tarifa is about 15 miles, the gradient will be about  $\frac{100 \text{ fathoms}}{15 \text{ miles}}$  or about 1 in 132. But it must be remembered that we have not here to do

with the *absolute weight* of this body of water, but only with the *difference* in specific gravity between water of (say) 1·027 and water of 1·029; which is less than  $\frac{1}{50}$  part of the absolute weight of the water thus carried up the slope.—It is not a little remarkable that in two sets of Specific Gravity observations very carefully taken at the Gibraltar end of the Strait, the water at 250 fathoms' depth was found to be considerably heavier than the bottom water at from 460 to 517 fathoms, as the following comparative statement shows :

		I. Specific Gravity.	II. Specific Gravity.	
Surface	.. .. ..	1·0271	1·0271	
250 fathoms	.. ..	1·0293	1·0292	
Bottom	.. .. ..	1·0281	1·0283	

This fact affords an additional indication of the existence of an impelling force sufficient to produce a current; since the heavier stratum could not otherwise have overlain the lighter.

54. An examination by the current-drag (§ 63) of the direction and rate of the movement, as well of the upper (Atlantic) as of the under (Mediterranean) stratum, was made at each end of the Strait, and also in the middle. The observations on the "ridge" were deemed more satisfactory by Captain Nares than those made elsewhere, being less affected by disturbing agencies; and these seemed to lead very decidedly to the conclusion, that both the upper *in*-current and the under *out*-current are more influenced by Tidal action than had been previously supposed, each of them undergoing a regular reversal on the "ridge" every six hours; while at the Gibraltar end of the Strait, the west-flowing tide-wave very commonly brings the surface *in*-current to a stand, if it does not actually reverse it, while it adds strength to the *out*-current beneath. The *balance* of the *upper*-current, however, is most decidedly *inwards*, while that of the *under*-current, though less considerable, is still decidedly *outwards*. But the quantity of water which each current conveys, is by no means as great as might be supposed from observations made only at the period of most rapid movement of that current.

55. It is obvious, however, that the existence of a Tidal flux and reflux in the Gibraltar currents no more proves that they are *sustained* by tidal action, than the existence of an alternate ebb and flow in a river proves that there is no down-flowing stream. In

every tidal river, the ebb is stronger on the whole than the flood; the excess being proportional to the amount of fresh water which the upper part of the river brings down. And thus it happens that a floating body thrown into such a river is at last carried out to sea, though it may have been brought back by the tide twenty, fifty, or a hundred times, each time stopping at a point a little further down than before. Now there can be no doubt whatever, that, putting the action of wind out of the question, a vessel which enters the western end of the Strait of Gibraltar would be gradually carried into the Mediterranean by the predominant *easterly* movement of the *upper* current; though its general easterly progress would be interrupted by a succession of returns to the westward, or, when there might be no actual return, by periods of rest. And the evidence is just as conclusive, that if a body could be so-weighted as to remain freely suspended in the Mediterranean stratum off Gibraltar, and its movements could be watched from above, we should find it in like manner gradually working its way towards the opposite end of the Strait, and at last clearing the "ridge" to descend along the Atlantic slope beyond. This it could not do, unless the tidal action were supplemented in each case by some other agency; and having already shown that the enormous excess of evaporation over the return by rain and rivers, affords an adequate explanation of the *inward* surface-current, we have now to enquire what explanation can be given of the *outward* under-current.

56. *Cause of the Outward Under-Current.*—Supposing that there were neither winds nor tides in the Strait of Gibraltar, an outflow of deeper water would take place, as a Physical necessity, in virtue of the excess of *downward* and therefore of *lateral* pressure in the Mediterranean over the Atlantic column, on the principle already stated (§ 5). For the effect of the inequality between evaporation and return of fresh water is to maintain a constant difference in salinity between the Mediterranean and the Atlantic water; the average Specific Gravity of the former being above 1·029, while that of the latter is about 1·027. The level of the Mediterranean column being kept up by surface-inflow as fast as it is lowered by bottom-outflow, the disturbed equilibrium, though constantly tending to restoration, never will be restored; and a double current will thus be constantly maintained. (See APPENDIX I.) But the under-current, like the upper-current, is liable to modification both by Winds and Tides. While the influence of the latter was very obvious, it was equally obvious that it no more accounted for the decided excess of deep outflow

over *inflow*, than it accounted for the decided excess of surface *inflow* over *outflow*. Of the influence of wind, we had more than one remarkable instance, which cannot, as it seems to me, be explained in any other way, than that, through a slight elevation in level, and in the specific gravity of the upper stratum, the direction of the under-current was reversed by a reversal of the relative pressures of the Atlantic and Mediterranean columns. It was noticeable that when a strong easterly wind was prevailing, the specific gravity of the surface-water was raised by the admixture of a westward drift of Mediterranean water with the Atlantic inflow; this being most perceptible at the Gibraltar end of the Strait, but showing itself also at Tarifa, and even, in a less degree, on the "ridge." Now the effect of this wind upon the inward surface-current was either to *check* it, or, when the ebb near full moon would have otherwise given it unusual strength, *very sensibly to retard it*. But, strange as it at first appeared, the effect upon the outward under-current was to give increased force to the tidal reversal, so that it set strongly *inwards*, at the estimated rate, in one instance, of 3·8 miles per hour. This anomaly, however, is readily explicable on the principle already set forth (§§ 3, 4). For the retardation of the surface inflow, by the opposing action of the wind at the eastern entrance of the Strait, must tend to produce in its narrowest part, which lies between Tarifa and Point Alcazar, a "head" of water, resembling that which is produced by the blowing of wind up a loch; and the increase of downward pressure produced by this, concurring with the increase in the specific gravity of the surface-layer, would obviously come in aid of the ordinary tidal reversal in the direction of the under-current, and would account for its extraordinary acceleration.\*

57. *Temperature of the Gibraltar In-Current.*—Having observed, on my first visit to the Strait, a marked *reduction* of Temperature in the mid-stream, as compared with that of the water nearer the Spanish side, I inferred that "either the water of which the in-current consists is drawn from a part of the Atlantic at least as far north as Lisbon, or that it is derived from a stratum of the neighbouring ocean somewhat beneath the surface, so as to have received less of the solar superheating than the actual surface-water." On the other hand, the *excess* of temperature in the surface-water of the Spanish side of the western *embouchure* of the Strait, was considered as indicating that there is a predominant surface-outflow of Medi-

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\* It is noticed in the Strait of Gibraltar that the time of the reversal of the flow does not coincide with that of high or low water, but precedes it by about three-quarters of an hour.

terranean water along the Spanish coast; a fact, I was informed, well known to those who have navigated it. Being desirous of obtaining further information on this point, I requested Capt. Nares to take observations of surface-temperature at short intervals, on the two occasions on which we were running obliquely across the Strait. One of these series (I.) extends along a line of about 10 miles from the neighbourhood of the Pearl Rock, at the entrance of Gibraltar Bay, to a short distance west of Point Cires on the African Coast; the other (II.) from Tarifa to the eastern entrance of Tangier Bay, a line of about the same length, but about ten miles further west. Besides these, another Series (III.) was taken along the

	L.		II.		III.	
	Deg. Fahr.			Deg. Fahr.		
Pearl Rock	.. .. 72½	Tarifa	.. .. ..	67	Cape Spartel	.. 68
"	.. .. 70½	"	.. .. ..	66	"	.. 68
"	.. .. 68½	"	.. .. ..	64	"	.. 65
"	.. .. 65½	"	.. .. ..	63	"	.. 64
"	.. .. 62	"	.. .. ..	62	"	.. 63
"	.. .. 60	"	.. .. ..	62	"	.. 63
"	.. .. 59	"	.. .. ..	63	"	.. 64
"	.. .. 60	"	.. .. ..	62	"	.. 62½
Point Cires	.. .. 60	Tangier Bay	.. .. ..	62	Tangier Bay	.. 60½

African coast, between a point a little to the west of Cape Spartel and the western entrance of Tangier Bay. And other observations taken to the S.E. of Europa Point gave temperatures of 70° and 71°·5, which corresponded with those obtained in the previous year near the entrance of the Mediterranean; its proper temperature being here somewhat reduced by the inflow of colder water through the Strait. Hence it appears, that whilst the water nearest the Spanish coast in Series I. had the temperature of the Mediterranean, there was a rapid fall in the thermometer as we came into the mid-stream, while a still further reduction occurred towards the African side,—the lowest temperature observed being 13°·5 beneath the highest, simply in changing our place a few miles to the southward. At Tarifa the influence of the Mediterranean temperature was less marked; but the temperatures taken near the African side within the embouchure of the Strait were nearly as low as in Series I.—I learned from Dr. Hooker, who had visited Morocco a short time before, that the prevalence along that coast of a temperature decidedly below that of the opposite coast of Spain, is a fact which has long been known locally; and that it is indicated at present by the character of the

Flora, whilst a still more marked reduction in past times is marked by the Boreal character of the Shells found in the later Tertiary deposits.

58. Now as a *surface*-temperature below 60° is not to be met with in the Eastern Atlantic during August (when these observations were taken) further south than the entrance of the British Channel,\* it seems clear that this cold stream must be derived from a *sub-surface* stratum. This fact has an important bearing upon the question (if question it be) whether the Gibraltar in-flow is a *wind-current*, propelled by a *vis a tergo*, or an *indraught* current drawn in by a *vis a fronte*. For, if it were the former—as maintained by Mr. Laughton and Mr. Croll (APPENDIX I.)—it *must* be a *surface-current*; and it is for them to show from what source *surface-water* below 60° could be supplied. If, on the other hand, it be an *indraught* current, sucked in through the Strait to supply the excess of evaporation in the Mediterranean, it would naturally be drawn from a *sub-surface* stratum, like the water flowing over a mill-dam.†

#### BLACK SEA.

59. *Physical Condition of the Black Sea.*—Though often treated in works on Physical Geography as an outlying portion of the Mediterranean basin, the Black Sea differs from the Mediterranean proper in this fundamental character,—that whilst in the latter the evaporation greatly exceeds the rain and river return, so that its level, and consequently its area, would be *reduced* (as in the case of the Caspian) by the closure of its communication with the Oceanic area, the rain and river supply of the former are in excess of its evaporation, so that if the Bosphorus and Dardanelles were closed, the level would *rise*, and the area would *increase*, until the two should come to an equality. The Mediterranean is to the Black Sea what the German Ocean is to the Baltic—the recipient of the excess of fresh water poured into its basin; but that this excess is much less than is commonly supposed, so that the great Black Sea rivers furnish but a very small contribution to the Mediterranean, will appear from the considerations now to be presented.

60. The area of the Black Sea, including the Sea of Azov, is nearly the same as that of the Caspian; namely about 180,000 square miles. Although the long axis of the former lies east and

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\* See the Series of 'Porcupine' Temperature-observations, in 'Proceedings of Royal Society,' Dec. 8, 1870, pp. 220, 221.

† See Capt. Maury's 'Physical Geography of the Sea,' § 387.

west, while that of the latter lies north and south, the two seas may be regarded as under nearly the same climatic conditions. Almost the whole of the Black Sea lies between the Annual Isotherms of  $50^{\circ}$  and  $60^{\circ}$ ; and the portion of the Caspian which lies to the north of the former is about equal to that which lies to the south of the latter. Hence we cannot be far wrong in estimating the Evaporation from the two seas as about the same. Now, as the whole of the water of the Volga and of the other rivers which discharge themselves into the Caspian, together with its rainfall, is only sufficient to compensate for *its* evaporation (§ 19), it is obvious that the outflow of the Black Sea into the  $\text{\textit{Aegean}}$  can be no more—assuming the rainfall over the two areas to be the same—than the *excess* of the water discharged into its basin by the Danube, Don, Dnieper, Dniester, and other rivers of less size, over that which is poured into the Caspian. That there *is* such an excess, is shown by the low Salinity of the Black Sea water, which averages something less than *half* that of Mediterranean water; its specific gravity varying from 1.012 to 1.014, according to the season. On the other hand, that this excess is not great, is shown by the fact that, although within the Strait of Gibraltar I was able to trace for some distance into the Mediterranean the reduction in specific gravity produced by the entrance of Atlantic water, whose salinity far more nearly approaches its own, yet the specific gravity of the water of the  $\text{\textit{Aegean}}$  is not sensibly reduced below that of the Mediterranean, by the reception, through the Dardanelles, of the half-saline water of the Black Sea. If there were *no* excess, the evaporation being merely equalised by the return of fresh water, the water of the Black Sea would have the salinity of that of the great basin with which it is in free communication. If, on the other hand, there were *no* inflow of the more saline water of the  $\text{\textit{Aegean}}$ , to compensate for the continual efflux of the half-salt water of the Black Sea, the whole of its salt would be ultimately washed out of its basin.

61. Now I urged in my former communication, that the Physical theory originally suggested by Captain Maury in regard to the under-currents of the Straits of Babel Mandeb and Gibraltar, ought to hold good, *mutatis mutandis*, for the Black Sea Straits, as well as for the Baltic; for that, whilst the outward surface-current is constantly tending to keep down the *level* of the Black Sea to that of the  $\text{\textit{Aegean}}$ , a constant excess of bottom- and, therefore, of lateral pressure, is produced by the much greater salinity of the  $\text{\textit{Aegean}}$ , which will suffice to maintain an inward under-current, the existence of which I ventured to predict on the double ground of *à priori*

and *à posteriori* necessity.\* This conclusion, however, was contested by Captain Spratt, who considered that his own experiments conclusively proved the deeper stratum of the Black Sea Straits to be *stationary*, when a strong surface-current was running outward.† To me it appeared, however, that Captain Spratt had neglected one very important consideration, namely, the "pull" of the surface-current on the suspending buoy; and that the stationary position of the "current-drag" hanging in the deeper stratum, really indicated that it must be acted-on by a current in the opposite direction, with a force equal to that which was acting on the suspending buoy. Thus I deduced from Captain Spratt's experiments a conclusion precisely opposed to his own;‡ and I found my interpretation of them supported by the opinion of naval officers who have made a special study, both theoretically and practically, of all matters relating to currents. Understanding, however, that the 'Shearwater,' when her survey of the Gulf of Suez had been completed, would proceed to the Dardanelles, I requested the Hydrographer to the Admiralty to cause a series of experiments to be there made with the "current-drag" which had been successfully used in the experiments made by Captain Nares and myself in the Strait of Gibraltar. These experiments were carried out with great skill by Captain Wharton, who succeeded Captain Nares in command of the 'Shearwater'; and the summary of their results, which I shall now give, is derived from the official account furnished by him to the Admiralty.

62. It is clear that the Dardanelles and Bosphorus surface-currents, while serving to carry off the excess of fresh water discharged by rivers into the Black Sea, are to a certain extent *wind-currents*. During about three-quarters of the year, the wind blows pretty steadily from the north-east, that is, *down* the Straits; and, as a rule, the stronger and more continuous the wind, the stronger is the surface out-current. On calm days the out-current of the Dardanelles is usually slack; and if, as sometimes happens, a strong wind blows from the south-west, its flow may be entirely checked. It requires a continuance of strong south-west wind, however, to *reverse* its direction; and its rate, when thus reversed, is never equal to that of the *out-current*. The speed of the Dardanelles current varies at different parts of the Strait, according to its breadth; being usually about one knot per hour at Gallipoli, and three knots in the "Narrows" at Chanak Kaleksi, where, with a strong north-easterly wind, it is sometimes as much as four and a-half knots; the average of the whole being estimated by Captain

\* 'Proceedings of the Royal Society,' Dec. 8, 1870, p. 213.

† *Ibid.*, June 15, 1871, p. 586.

‡ *Ibid.*, June 13, 1872, p. 639.

Wharton at one and a-half knot.—The Bosphorus current has not been as carefully studied as that of the Dardanelles; but Captain Wharton states that its rate is greater, averaging about two and a-half knots per hour, apparently in consequence of the limitation of its channel, which is scarcely wider at any point than is the Dardanelles at the "Narrows." It continues to run, though at a reduced rate, when there is no wind; and it is only in winter, after a continued south-west gale of long duration, that a *reversal* of the Bosphorus current ever takes place. The continued outflow of the Bosphorus current, when there is no wind, may be taken as evidence that there *is* an excess to be discharged, and that, though affected by wind, this outflow is *not dependent* upon it.

63. It might have been supposed that, as the greatest depth of these two Straits does not exceed fifty fathoms, the determination of the question as to the existence of an under-current would be a comparatively easy matter. But it is rendered difficult by the very rapidity of the movement, alike in the upper and in the lower stratum. The result of the earlier experiments made by Captain Wharton, in which he used the current-drag that we had worked satisfactorily in the Strait of Gibraltar, corresponded pretty closely with those of Capt. Spratt; no other than *inferential* evidence being obtained of the existence of an inward under-current. But perceiving from the very oblique direction of the suspending line (Diag. III.)

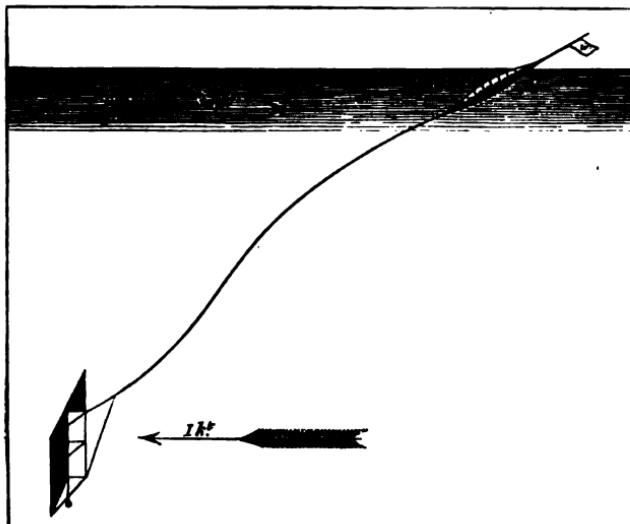
DIAGRAM III.



that the under-current must be acting on the current-drag at a

great disadvantage, Captain Wharton set himself to devise a drag which should hang vertically, even when the suspending line was oblique (Diag. IV.), so as to expose a large surface to the impact of

DIAGRAM IV.



a current at right angles to it. This worked satisfactorily, and gave the most conclusive evidence of the existence of a powerful under-current, by dragging the suspending buoy *inwards* against the surface-current; the force of which, aided by wind, was sufficient on several occasions to prevent the row-boats from following the buoy, only the steam-cutter being able to keep up with it.—The following, which is the most striking of all these results, was obtained in the Bosphorus on the 21st of August, 1872, with a surface-current running outwards at the rate of three and a-half knots per hour, and a north-east wind of force 4. “When the current-drag was lowered to a depth afterwards assumed to be 20 fathoms, it at once rushed violently away against the surface-stream, the large buoy and a small one being pulled completely under water, the third alone remaining visible. It was a wonderful sight to see this series of floats tearing through the water to windward. The steam-cutter had to go full speed to keep pace with it.” When sunk 2 fathoms deeper, the strain was so great as to pull all three buoys beneath the surface; but in three-quarters of an hour they reappeared at about two-thirds of a mile to windward, the drag having grounded. It is obvious that the real rate of the under-current

must be very much greater than that indicated by the movement of the float, since the current-drag impelled by it had to draw the large suspending buoys and the upper part of the line against the powerful surface-current running at three and a-half knots an hour in the opposite direction; *their* motion through the water, therefore, being nearly four and a-half knots an hour.

64. The difference in the Specific Gravity of water obtained from different depths, was usually found in Captain Wharton's investigations, as in those made by myself in the Strait of Gibraltar (§ 52), to afford, under ordinary circumstances, a very sure indication of the direction of the movement of each stratum; the *heavy* water of the *Ægean* flowing *inwards*, and the *light* water of the Black Sea *outwards*. And it was indicated alike by both modes of inquiry, that the two strata move in opposite directions, one over the other, with very little intermixture or retardation; the passage from the one to the other being usually very abrupt. In a few instances, there was a departure from the usual rule; an *outward* movement being found in the *deepest* stratum, while the middle stratum was moving *inwards*, though the water of both these strata had the density of the *Ægean*. These anomalies are considered by Captain Wharton to proceed from the prevalence of opposite winds at the two ends of the Strait.

65. As a general rule, the strength of the *inward* under-current was proportioned to that of the *outward* surface-current; and this was very remarkably shown in cases in which, both having been slack during a calm, an increase of wind augmented the rates of both currents alike. That a wind blowing *outwards* should promote the flow of an under-current *inwards*, may at first sight appear anomalous; but it is very easily accounted for. Suppose that a moderate south-west wind, by checking the surface-outflow, keeps the level of the Black Sea just so much above that of the *Ægean*, that the greater *density* of the latter column is counterpoised by the greater *height* of the former; then, as the *bottom*-pressures of the two are equal, their *lateral* pressures will also be equal, and there will be no under-current so long as this condition lasts. But so soon as, on the cessation of the south-west wind, the level of the Black Sea is lowered by a surface-outflow, the *Ægean* column comes to be the heavier, and its excess of lateral pressure produces a deep inflow. And when this *outflow* is further aided by a north-east wind, so that the levels of the two seas are equalised, or there is even an excess of elevation at the *Ægean* end, the greater weight of the *Ægean* column will produce a greater lateral pressure,

and will consequently increase the force of the inward under-current.\*

66. The proportional force and volume of the two currents cannot be estimated from these experiments with anything like certainty; but Captain Wharton thinks that the under-current sometimes carries *in* as much as *two-thirds* of the water that the surface-current carries *out*. That it ordinarily returns at least *half*, may be fairly inferred from the constant maintenance of the average salinity of the Black Sea water at about half that of Mediterranean water; since it is obvious that this proportion could not be kept up, unless as much salt re-enters the basin by the under-current, as passes out of it by the upper. Hence as the *salinity* of the under-current is *twice* that of the upper, its *volume* may be taken at about *one-half*; so that the *actual excess* of outflow will be only about *one-half* of the volume of water that forms the surface-current.—It is certain, however, that these conditions are considerably modified at different periods of the year. During the winter months a large proportion of the drainage-area of the Black Sea rivers is constantly covered with snow, so that the quantity of water they bring down is comparatively small; and at this time the prevalent wind in the Black Sea Straits is from the south-west, so that the surface-movement is inwards. But though the supply of water is reduced, the evaporation is also reduced; and thus it comes to pass that there is still a sub-surface outflow from the Black Sea into the Mediterranean, as is proved by the direction of the water-weeds.† It is in the spring and early summer, when the snows melt, that the Black Sea rivers bring down their largest supply of water; and it is then that the specific gravity of Black Sea water is at its lowest, and

\* The influence of a slight difference of level in producing a difference of downward and therefore of lateral pressure, and thus giving rise to an under-current, is well shown in the following case recorded by one of the United States Coast Surveyors, with reference to the current of cold water which runs inwards through the Florida Channel beneath the Gulf-Stream. "The exit of the water brought down by the Hudson River is so much impeded by the 'Narrows' of New York Harbour, that the surface-level of the river is always higher than that of the sea outside; and as the difference is ordinarily sufficient to do more than compensate for the excess in the weight of the column of sea-water outside above that of the column of river-water inside, no deep inflow of sea-water takes place. But during the dry summer-season, the level of the river comes down so nearly to an equality with that of the sea, that the outside column becomes the heavier; and a deep inflow of salt water then takes place, extending a good way up the river, though the surface outflow, consisting of water thus rendered brackish, continues for nine out of the twelve tidal hours."—See Mitchell in 'Silliman's American Journal,' vol. xlivi. (1867), p. 74.

† Of this I have been assured by a gentleman formerly residing at Constantinople, who won a guinea-bet by thus demonstrating to his opponent the continuance of the outflow, notwithstanding the opposing action of the wind upon the surface.

that the outward surface-current is most distinctly an *overflow* current, and least dependent on wind.—It is much to be desired that observations on the Black Sea currents should be made at that season also; since those of Captain Wharton were carried on at a time when the evaporation must still have been considerable and the excess of river-supply small, so that the influence of the wind would be more decided.

67. On the whole, it may be affirmed with certainty, that the excess of Black Sea water discharged into the Ægean, above that of Ægean water flowing back into the Black Sea basin as an under-current, cannot contribute to the supply of the enormous evaporation of the Mediterranean as much as would be discharged into it by a single considerable river.

#### BALTIC SEA.

68. *Physical Condition of the Baltic.*—Of all large Inland Seas, the Baltic is the one in which the quantity of fresh water brought into its basin by rain and rivers bears the largest proportion to its loss by evaporation; as is indicated by its Specific Gravity, which, while varying greatly in different parts of its area, and at different seasons, averages much less than that of the Black Sea. Its area is estimated at about 160,000 miles, or rather less than that of the Black Sea; and its drainage-area is nearly as extensive, being estimated at about one-fifth of the whole area of Europe. It is not only, however, the extent of its drainage-area, which determines the quantity of water that flows into it by rivers; for this depends even more upon the amount of rain and snow which falls upon that area, and the proportion of this which is dissipated by evaporation before the rivers which collect it discharge themselves into the basin. Now there is probably no inhabited region in which such a quantity of snow falls, as it does in the countries round the Baltic. They receive direct from the Atlantic a vast amount of moisture brought by its west and south-west winds; and even the winds which have already passed over the low plains of Jutland and Northern Germany, will have parted with little of their moisture before reaching the Baltic provinces of Russia. When these vapour-laden West and South-west winds meet the cold dry East and North-east winds of Siberia, their moisture is precipitated,—in winter as snow, and in the summer as rain; and owing to the prevalence of a low atmospheric temperature, the proportion lost by evaporation is comparatively small. While the climate of Norway is ameliorated in a very remarkable manner by the afflux

of warm water to its shores (§ 112), this amelioration does not extend to the Swedish side of the watershed which separates the two countries. A large part of this, together with the Gulf of Bothnia and Russian Finland, lies between the winter isotherms of  $10^{\circ}$  and  $20^{\circ}$ ; whilst the southern portion, with the Baltic proper, and the German portion of its borders, lies between the winter isotherms of  $20^{\circ}$  and  $30^{\circ}$ . The average summer-temperature, though high in proportion to the latitude, is from  $15^{\circ}$  to  $20^{\circ}$  lower than that of the Mediterranean, Black Sea, and Caspian. And while the *mean annual* temperature of the Mediterranean ranges between  $60^{\circ}$  and  $70^{\circ}$ , and that of the Black Sea and of the middle basin of the Caspian between  $50^{\circ}$  and  $60^{\circ}$ , that of the southern portion of the Baltic and of the area it drains averages about  $45^{\circ}$ , and that of the Gulf of Bothnia and its borders ranges between  $40^{\circ}$  and  $30^{\circ}$ .

69. It is obvious, therefore, that the evaporation, alike from the surface-water of the basin itself, and from the drainage-area which feeds it, will be very small in comparison with that of either of the great Inland Seas of southern Europe; so that if, by an elevation of the southern part of the Scandinavian Peninsula, the Baltic should be cut off from communication with the German Ocean, its level would be raised by the excess of fresh water discharged into its basin over the amount lost by evaporation, until the increase of the latter, by the extension of its evaporation-area, should bring the two to an equality. As it has an outlet, however, by the Sound, the Great Belt, and the Little Belt, there is ordinarily a general movement of the upper water of the Baltic towards that outlet, and a considerable outflow through it. The greatest volume of fresh water is discharged by the numerous rivers that empty themselves into the northern part of the Gulf of Bothnia, which may be regarded as a sort of estuary; so that their united waters form a southward current, which is very rapid where the gulf narrows at Quarken (being partly blocked up by the Walgrund Islands), and again where it is divided by the Aland Islands at its junction with the Baltic proper. This current is usually perceptible over the general surface of the Baltic, though it is liable to considerable modification from prevalent winds. It is in spring and in the early part of summer, when the snows are melting, that the discharge of river-water into the basin of the Baltic is greatest, and its outflow current the strongest. During the winter, on the other hand, a considerable part of the Gulf of Bothnia is usually frozen over; and large masses of ice are often seen between Stockholm and the Russian islands of Dagoe and Oesel, showing the comparative stillness of its surface.

70. The Salinity of the water differs greatly, as might be inferred from what has just been said, in different parts of the Baltic; and varies also with the season of the year. In the Gulf of Bothnia, the water is often so little salt as to be quite drinkable,—its specific gravity having been observed as low as 1·004. But it is said to contain at Christmas six times the quantity of salt that it contains at Midsummer; showing that when the river supply is at its lowest, there must be a large reflux of salt water from the outside ocean. In fact, it is certain that in the Baltic proper, the water of the deeper stratum is much more saline than that of the upper stratum; the latter flowing over the former in its way towards the outlet of the basin, just as the fresh-water current of a great river runs out to sea, far beyond the sight of land. It is obvious that if it were not for this reflux of salt water, the basin would come in no long time to be occupied by fresh water; and the variation just mentioned as observable in the Gulf of Bothnia, accords well with the example, on a smaller scale, already cited in regard to the River Hudson (§ 65, *note*). When its level is raised by the influx of river-water, the downward pressure of its column, although consisting of water of very low specific gravity, becomes greater than that of the salt water of the German Ocean, and no reflux of the latter takes place. But as soon as its level has been reduced by the stoppage of the river supply, the salt-water column becomes the heavier, and a reflux takes place.

71. Thus the conditions on which depend the movements of the water in the Straits whereby the Baltic communicates with the German Ocean, differ greatly at different periods of the year. As a general rule, there is an outward surface-current of greater or less strength, which is obviously an overflow-current; and that, when such is the case, there is ordinarily an inward under-current of Oceanic water, may now be considered as unequivocally proved by the careful researches of Dr. Meyer, of Kiel,\* who has been for some years engaged in the investigation of this subject, and who is perfectly satisfied that large bodies of water in the Baltic Straits are thus put in motion by differences of Specific Gravity. That both the upper and the under-currents should be affected by prevalent Winds, is only what is to be expected from what has gone before. When a wind, blowing in the opposite direction, keeps back the surface-current, and banks up its water, the downward pressure of the inside column may come to equal or even to exceed that of the outside column; and the under-current will be

\* 'Untersuchungen über physikalische Verhältnisse des westlichen Theiles der Ost-See.' Von Dr. H. A. Meyer, Kiel.

brought to a stand in the first case, and will be reversed in the second—as we found it to be in the Strait of Gibraltar (§ 56). On the whole, however, it is obvious that the strongly saline under-current, with the aid of the occasional reversal of the surface-current, must carry back as much salt into the basin of the Baltic, as is carried forth by the surface-current of water of low salinity, which usually sets outwards through the three channels whereby it communicates with the German Ocean.

#### NORWEGIAN FJORDS.

72. The thermal condition of the deep Fjords on the western coast of Norway is of great interest, as confirming the general doctrine that a body of deep water, cut off from communication with the corresponding stratum of the ocean, will have a uniform temperature, not subject to reduction with depth; and that this temperature will be that of the *isochimal* of the locality. It is well known that many of the Norwegian Fjords are of great depth in their middle part—the Sogne Fjord, for instance, going down to 700 fathoms—but are shallow near their mouths; so that all, save their superficial stratum, is really in a state of seclusion from any exterior thermal influence. Now it has been ascertained by Professor Mohn, of Christiania, that alike in the Trondhjem, the Sogne, and the Hardanger fjords, a constant temperature of about  $43\frac{1}{4}^{\circ}$  is met with at 50 fathoms' depth, which continues unchanged to the bottom. This agrees very closely, not with the atmospheric isochimal—which is much lower—but with the mean winter temperature of the flow of warm water, which reaches the coast of Norway from the south-west, and which keeps open its fjords and harbours (§ 112). It is obvious that so long as the warmth of the upper stratum is kept up by its constant renewal, the winter depression of atmospheric temperature below the freezing-point cannot act upon the water that occupies the deeper parts of the fjords; and that its temperature will represent that to which the surface-water is brought down by the colder air above it.

#### SEA OF OKHOTSK.

73. A contrary condition seems to prevail in the Sea of Okhotsk, which is a basin of no great depth, shut in by the peninsula of Kamtchatka, the large islands of Sagalian and Yesso, and the chain of the Kurile islands, between which there are shallow straits. Here Dr. Horner, who accompanied Krusenstern's Expedition, found the surface-temperature in August to be  $46^{\circ}4$ ; but at only 18

fathoms' depth, the thermometer sank to  $31^{\circ}6$ , at 60 fathoms to  $28^{\circ}8$ , and at 115 fathoms to  $28^{\circ}6$ . Thus it is obvious that the deeper water permanently retains the low winter-temperature of that region; only the superficial stratum of about 50 fathoms having its temperature raised by the warmth of the summer sun, though the July isotherm of  $60^{\circ}$ , which runs through the middle of England, crosses the Sea of Okhotsk in nearly the same parallel of latitude.

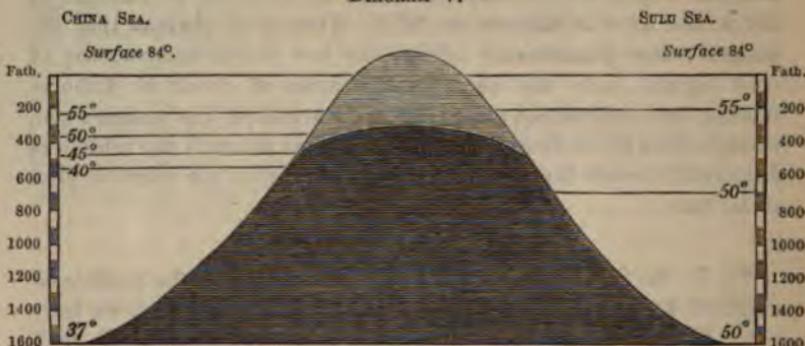
#### SULU SEA.

74. In the Sulu Sea, a small area lying between the north-east angle of Borneo and the south-west portion of Mindinao, we have another very interesting example of the effect of *seclusion* on the temperature of water occupying a basin whose deeper part is cut off from communication with the outside Ocean. Although not ostensibly an Inland Sea, being but very partially enclosed by land, it is so surrounded by reefs and shoals, as to have only a superficial and limited communication with either the China or the Celebes Sea. Notwithstanding this enclosure, its depth is very great, ranging to 1778 fathoms; and its temperature-phenomena present exactly the same contrast with those of the China Sea, that the temperature-phenomena of the Mediterranean present when compared with those of the Eastern Atlantic, as shown in Diagram V. (next page), and more particularly in the following comparative Table of the temperature-soundings taken by Captain Chimmo in the two seas:—

		Sulu Sea.	China Sea.
Surface	.. .. .. ..	83	84
30 fathoms	.. .. .. ..	..	77
40	.. .. .. ..	..	74
50 to 80 fathoms	.. .. .. ..	..	71
100 fathoms	.. .. .. ..	64·5	
120	.. .. .. ..	..	62
150	.. .. .. ..	..	56
200	.. .. .. ..	56·2	51
250	.. .. .. ..	..	49
308	.. .. .. ..	51·5	
416	.. .. .. ..	..	41
500 to 1778 fathoms	.. .. .. ..	50	
550 to 1546	.. .. .. ..	..	37

Thus it appears that with surface-temperatures almost exactly identical, and with a rate of descent through the first 100 fathoms nearly the same, there is a most marked difference beneath. For whilst in the Sulu Sea the thermometer only falls to  $56^{\circ}2$  at 200

DIAGRAM V.



fathoms, to  $51\frac{1}{2}^{\circ}$  at 308 fathoms, and to  $50^{\circ}$  at 500 fathoms, and the temperature is uniform from that point down to the bottom at 1778 fathoms,—it descends rapidly in the China Sea to  $51^{\circ}$  at 200 fathoms, thence to  $41^{\circ}$  at 416 fathoms, and thence to  $37^{\circ}$  at 550 fathoms, at which point it remains stationary down to the bottom at 1546 fathoms. The marked difference in the temperatures of the deeper strata of the two seas is attributed by Capt. Chimmo—in my opinion with adequate reason—to the exclusion from the Sulu Sea of the deep Polar flow which lowers the temperature of the China Sea. And the more rapid fall in the temperature of the upper 200 fathoms in the China Sea appears attributable to the same condition; since among the temperatures taken at 200 fathoms by the school-ship 'Mercury' (§ 142), between Sierra Leone and the Cape de Verde Islands, there were three which showed a marked elevation—namely, from  $53^{\circ}$  and  $54^{\circ}$  to  $58^{\circ}$  and  $60^{\circ}$ ; and these three were over bottoms too shallow to receive the cold Polar stratum that overflows the bottom over which the lower temperatures presented themselves.

75. If, now, we enquire by what the constant temperature of the deeper stratum of the crater-like basin of the Sulu Sea is determined, we find it to be clearly *not*—as in the Mediterranean and the Red Sea—the atmospheric isocheimal, which would be not lower than  $75^{\circ}$ ; but to be obviously that of the coldest water that can find its way into the basin from the China or the Celebes Sea, through the passages between the reefs and islands; and we might even fix the depth of those passages at about 250 fathoms.\* And thus, while in the Norwegian Fjords the constant temperature is raised by the afflux of an upper stratum which derives its excess of

\* See §§ 8, 9 of my Report for 1871, in the 'Proceedings of the Royal Society' for June 13, 1872.

warmth from Equatorial heat, in this Sulu Sea it is *lowered* by the entrance of a sub-surface stratum whose reduced temperature depends on an afflux of Polar water.

## PART II.—GENERAL OCEANIC CIRCULATION.

### *Prefatory Remarks.*

76. In the introduction to my former communication, I stated that "I claim no originality whatever in advancing the doctrine "of a General Oceanic Circulation sustained by difference of Temperature. It has been hinted at by various writers, especially "Professor Buff and Captain Maury; though, so far as I am aware, "it has not been formally propounded by any." I have since learned, however, from Mr. Prestwich, who had made a special study, for Geological purposes, of all the inquiries into Deep-Sea Temperature carried out before the commencement of the investigations which led me to this doctrine, that similar views had long previously been adopted by Physicists of great eminence,\* although they had never commanded general acceptance; having, alike in this country and in France, been put aside in favour of the doctrine of the uniform Deep-Sea Temperature of  $39^{\circ}$ , which was generally supposed to have been established by the observations made in D'Urville's and Sir James Ross's Expeditions, and which had been accepted by Sir John Herschel, who stamped it with the impress of his high authority.

77. It was under this impression that Professor Wyville Thomson and I entered upon our 'Lightning' Cruise of 1868; in which we encountered, on certain parts of the bottom of the Channel between the North of Scotland and the Faroe Islands, at depths between 500 and 600 fathoms, a temperature of  $32^{\circ}$ , which subsequent observations with "protected" thermometers have shown to be really  $29\frac{1}{2}^{\circ}$ ; whilst in other parts of the same area we found, at similar or even greater depths, a temperature of  $46^{\circ}$ , which subsequent observations have shown to be really  $43\frac{1}{2}^{\circ}$ . The contrast between the Arctic character of the Fauna of the "cold area," and the warmer temperate character of that of the "warm area," strongly impressed me with the conviction that this contrast must depend upon two great movements of Ocean-water in opposite directions: a cold stream flowing from north-east to south-west, and a warm stream flowing from south-west to north-east. And I was further led to the con-

\* A most elaborate Memoir on this subject has recently been presented by Mr. Prestwich to the Royal Society; from which the statements in §§ 82, 83 are derived.

clusion that the latter could not be the *true* Gulf-Stream or Florida Current; since all our knowledge of it indicates that it is so far spread out and dispersed in the Mid-Atlantic, that its influence near the Faroe Islands cannot possibly extend to a depth of from 600 to 700 fathoms. I then learned for the first time (my ordinary studies having lain in quite a different direction), that the existence of "Polar currents," extending to the Equator, was well known to Physicists; and the experiments which were made (in anticipation of the 'Porcupine' Expedition of 1869) "on the influence of water-pressure on Thermometers," having satisfied me that the observations taken in Sir James Ross's Antarctic Voyage were probably to be interpreted as indicating the general prevalence of a Deep-Sea Temperature not much above  $32^{\circ}$ , I was led to the idea of a general Oceanic Circulation dependent on Thermal Agency alone, which should bring a deep stratum of Polar water to the Equator, and carry the upper stratum from the Equator towards the Poles. This idea was confirmed by the results of the systematic Temperature observations taken during the summer of 1869, in the deep water near the Eastern border of the Atlantic basin, as well as in the channel previously explored in the 'Lightning.' For whilst in the latter we found two very distinct strata,—the upper warm, the lower cold,—separated by a "stratum of intermixture," in which the thermometer went down  $15^{\circ}$  in 100 fathoms; so in the former, we found that after passing through the superheated layer of surface-water, the thermometer sank very gradually to 700 or 800 fathoms, then rapidly in the next 200 fathoms (the "stratum of intermixture"), and then again slowly down to about  $36\frac{1}{2}^{\circ}$ ; thus indicating the existence, in the broad and deep Atlantic, of the distinction which was so strongly marked in the (comparatively) narrow and shallow 'Lightning' channel. This distinction I was able to work out still more satisfactorily from temperatures taken off the coast of Portugal in the two following years; and the temperature-observations which I took in the Mediterranean seemed to me to place the existence of this General Oceanic Circulation beyond doubt, by showing that depth, *per se*, has no effect in reducing the temperature of Ocean-water, and that the difference between the temperature of the deepest stratum of the Mediterranean and that of the outside Atlantic, under the same latitude (§ 35), can only be attributed to the derivation of the latter from a Polar source.

78. But, further, the enquiries in which I took part with Captain Calver, in regard to the Under-current of the Strait of Gibraltar, led me to consider the nature and action of the forces by which

that and other under-currents are sustained ; and adopting Captain Maury's view, that the *outward* under-current of the Strait of Gibraltar, together with that which may be presumed to exist in the Strait of Babel Mandeb (§ 29), are due to the difference between the Specific Gravities of the interior and the exterior columns, I came to perceive that the same principle would apply, *mutatis mutandis*, to the case of Inland Seas of which the salinity is less, instead of greater, than that of the Ocean ; and that an *inward* under-current of heavy water should exist in the Baltic Sound and the Black Sea Straits. Of the existence of the former, I was able to adduce adequate evidence ; that of the latter, which I could only predict, has since been fully established (§ 63).

79. Thus, then, I was enabled, in my former communication, to group all these phenomena as necessary results of a disturbance of Hydrostatic equilibrium ; produced in one case by the increase of Density, occasioned by Polar Cold, and the reduction of density occasioned by Equatorial Heat ; and in the other, either by the increase of Salinity produced by excessive evaporation, or by the reduction of salinity produced by an excessive inflow of fresh water. It was with special reference to this part of my enquiry that I took occasion to say,—“ If I have myself done anything to strengthen “ the doctrine, it has been by showing that Polar Cold, rather than “ Equatorial Heat, is the *primum mobile* of this circulation ; and, “ further, by bringing a large number of phenomena, apparently un-“ related, under the comprehension of the same Physical Theory.” Not having myself the least claim to more than an elementary knowledge of Physical Science, I should never have ventured to put forth my own ideas on a matter so foreign to the studies to which my life has been devoted, if I had not been able previously to discuss them with men of the very first eminence as Mathematical Physicists. Finding, however, that the views I advocated were regarded by them as quite consistent with universally accepted principles, I thought myself justified in placing them before the Scientific public as having a fair claim to consideration.

80. Such consideration was accorded to them by Sir John Herschel, who had previously, with his habitual candour, completely abandoned the doctrine of the uniform Deep-Sea Temperature of  $39^{\circ}$  ; and who, in one of his last scientific letters (written only three weeks before his death), expressed himself as follows with reference to my Paper in your ‘Proceedings,’ which I had sent to him with a request for his opinion thereon :—“ Assuredly, “ after well considering all you say, as well as the common sense

" of the matter, and the experience of our hot-water circulation-pipes in our greenhouses, &c., there is no refusing to admit that " an Oceanic circulation of some sort must arise from mere Heat, " Cold, and Evaporation, as *veræ causæ*; and you have brought " forward with singular emphasis the more powerful action of the " Polar Cold, or rather, the more *intense* action, as its maximum effect " is limited to a much smaller area than that of the maximum " of Equatorial Heat. The action of the Trade and Counter-trade " Winds, in like manner, cannot be ignored; and, henceforward, the " question of Ocean-currents will have to be considered under a two- " fold point of view." The doctrine of a Thermal Oceanic circulation was also formally accepted by Sir George Airy, in his Presidential Address to the Royal Society in 1872, as " certain in theory, and supported by observation." And Sir William Thomson has, at three successive meetings of the British Association, expressed his full concurrence in my views, both as to the Physical cause of Under-currents in Straits (§ 11), and the competence of disturbance of Thermal equilibrium to maintain a General Oceanic Circulation.

81. The opposition which has been raised to the doctrine of a Thermal Circulation has mainly rested on one or both of two pre-conceptions:—(1) the origination of all Oceanic movements in the surface-action of Wind; and (2) the sufficiency of the Gulf-Stream to produce that amelioration of the Climate of North-western Europe, which is admitted on both sides to depend on an afflux of warm water. It is chiefly on the second of these grounds that the doctrine is dissented from by my friend and former colleague, Professor Wyville Thomson, by whom the subject has been discussed in a chapter of his ' Depths of the Sea' devoted to " The Gulf-Stream;" and as this is a question of special interest, I shall hereafter discuss it in detail (APPENDIX III.). His conclusion is " that although movements, some of them possibly of considerable " importance, must be produced by differences of specific gravity, " yet the influence of the great current which we call the Gulf- " Stream, the reflux of the great Equatorial Current, is so para- " mount as to reduce all other causes to utter insignificance" (p. 406). Mr. Laughton, whose strong advocacy of the exclusive Wind-Current theory I have already had occasion to criticize, nevertheless seems inclined to admit that difference in specific gravity may produce " a continual but imperceptible interchange " between the waters of polar and tropical seas;" though he still in part attributes the cold of the deeper stratum of the latter " to " the great depth, to the impermeability of water by the sun's rays, " to the dispersion of the heat which such water as is driven to the

"bottom carries along with it;"\* the Gulf-Stream being regarded by him also as the sole ameliorator of the climate of Northern Europe. By Mr. Croll, however, who had previously taken up both antagonistic positions,—viz., that all Ocean-movements are produced by the agency of Wind alone, and that the Gulf-Stream is the sole carrier of Equatorial heat to the Arctic area,—it has been persistently asserted that such differences in Specific Gravity as are producible by differences of Temperature or Salinity are utterly inadequate to sustain any Oceanic movement, however slow; and that the doctrine of a Thermal Oceanic Circulation is consequently unsound in theory, whilst all the facts adduced in support of it are explicable (he alleges) on the hypothesis of the origin of every Ocean-movement in Wind-drift.†

82. I am glad, therefore, to be now enabled by Mr. Prestwich's aid, to cite the explicit authority of one of the most eminent Physicists of his time, Professor Lenz of St. Petersburg,‡ who, nearly thirty years ago, advanced—in terms almost identical with my own—the doctrine of a General Oceanic Thermal Circulation, as *an inevitable deduction* from the facts ascertained by the remarkable series of observations on the Temperature and Specific Gravity of Oceanic water at various depths, which he had made in the second Voyage of Kotzebue during the years 1823-6. Distrusting the self-registering thermometers then in use, Lenz devised a method of obtaining Deep-Sea Temperatures, which, though complicated, proved in his hands so satisfactory, that I find his results in singular conformity with those obtained by the "protected" thermometers of the 'Challenger.' He drew from these results the very conclusions to which I was led by my own observations in the first instance, and which now appear to me to derive remarkable confirmation from the Temperature-soundings and Specific Gravity observations of the 'Challenger'; namely—(1) The doctrine of a deep under-flow of glacial water from each Pole to the Equator; (2) the ascent of Polar water towards the surface under the Equator, as evidenced by the rise of the bathymetrical isotherms, by the keeping-down of the surface-temperature, and by the low (Polar) salinity of Equa-

\* 'Physical Geography in its Relation to the Prevailing Winds and Currents,' 2nd edit., p. 201.

† See his series of Papers on "The Physical Cause of Ocean Currents," in the 'Philosophical Magazine,' 1870-1874.

‡ Though little known in this country, Lenz was regarded by Gauss and Jacobi (as I learn from Sir Charles Wheatstone) with the highest esteem. The list of his Physico-Mathematical Memoirs occupies four columns of the Royal Society's 'Scientific Catalogue.' And his 'Physikalische Beobachtungen, angestellt auf einer Reise um die Welt unter dem Commando des Capitäns von Kotzebue in den Jahren 1823-25' (St. Petersb. Acad. Sci. Mém. I., 1831), would of itself be sufficient to stamp him as a master in Physical investigation.

torial surface water; (3) the movement of the upper stratum of Oceanic water from the Equatorial region towards each Pole, as the necessary complement of the deep Polar under-flow; and (4) the dependence of this double movement upon the disturbance of Hydrostatic equilibrium constantly maintained by Polar Cold and Equatorial Heat.\*

83. The same doctrine seems to have been deduced by Arago from the Temperature observations made by Du Petit Thouars in the voyage of the 'Venus'; and he further supported it by the very argument I have myself drawn from the Thermal condition of the Mediterranean (§ 35). For this having been observed by D'Urville in 1829, led Arago to point out, in 1838, that its constant temperature from 100 fathoms downwards can only be accounted for by the exclusion of the deep Polar under-flow, which is shut out by the shallowness of the Strait of Gibraltar at its western entrance. And Pouillet,† in 1847, distinctly accepted the doctrine of an upper Equatorial-Polar and a lower Polar-Equatorial movement, kept up by the difference of pressure between the Polar and Equatorial columns.

84. The doctrine of a General Oceanic Circulation sustained by Thermal agency alone, having thus been fully accepted by Continental Physicists of the first eminence, it seems strange that it should have been since so completely forgotten. My own ignorance of its anterior promulgation may, I venture to think, be readily excused on the ground I have already stated (§ 77). Not one of the eminent Scientific men whose assistance has been freely accorded to me, seems even to have heard either of Lenz's investigations, or of the conclusions he drew from them. Had it not been, therefore, for Mr. Prestwich's patient research, we should all have remained in our ignorance. To myself it is a matter of the greatest gratification to find that an important doctrine, which I could myself only advocate on the basis of what Sir John Herschel calls "the common sense of the matter," was originally promulgated in the fullest and most explicit manner by one great Mathematical Physicist, and was expressly adopted by two others. This, I venture to think, is sufficient to relieve me from the necessity of here entering into a discussion of Mr. Croll's theoretical objections. (See APPENDIX II.)

85. In accordance with the views expressed at the conclusion of my former Paper, I took the earliest opportunity which presented itself of urging upon H.M. Government the further prosecution of

\* "Bemerkungen über die Temperatur des Weltmeeres in verschiedenen Tiefen." (St. Petersb. Acad. Sci. Bull. V., 1847.)

† 'Eléments de Physique,' 5<sup>ème</sup> ed., tom. II., p. 667.

Physical in conjunction with Biological investigations into the condition of the Deep Sea ; and the 'Challenger' Expedition, which was thus originated, having now carried out a Temperature-Survey of the Atlantic between about 38° N. Lat. and 38° S. Lat., with a completeness which leaves little to desire, I proceed to the discussion of the results thus obtained : first, however, drawing attention to the predictions I had ventured to put forth (in entire ignorance of Lenz's remarkable anticipations), since the exact verification of these gives great support to the Doctrine on which they are based :—

a. That instead of the local depressions of Bottom-temperature imputed by previous writers to "polar-currents," the temperature of every part of the Deep-Sea bed in free communication with either of the Polar areas, would be not many degrees above that of the glacial bottom in the Polar areas themselves.

b. That this general depression of Bottom-temperature would be found to depend, not upon such a shallow glacial stream as might be maintained to be a return from the Polar areas of water propelled towards them by wind-currents, but upon a "creeping flow" of the whole under-stratum, having a thickness of from 1000 to 2000 fathoms.

c. That the depression of Bottom-temperature in any part of the general Oceanic basin, would be proportional to the freedom of communication between that part and one or other of the Polar areas.

d. That the Bottom-temperature of the South Atlantic would thus be lower than that of the North Atlantic, in consequence of its greater freedom of communication with its adjacent Polar area.

e. That the Bottom-temperature of the North Atlantic would probably not be found below 35° (Fahr.), except in or near the course of the main Arctic or Antarctic under-flow.

f. That the Bottom-temperature of the South Atlantic would probably be as low as 32°.

g. That the influence of the stronger Antarctic glacial under-flow would very probably extend to the north of the Equator.

h. That as the Arctic and Antarctic under-flows must meet at or near the Equator, whilst the surface-stratum is being continually draughted off thence towards either Pole, there would be a *continual ascent of glacial water* under the Line, showing itself by a *nearer approach of cold water to the surface* in the *inter-tropical* than in the *extra-tropical Zones*; or, as it was well put by Lenz, that there is under the Equator a belt of water which is colder than the water to the north and the south of it.

i. That as the *excess* of easterly momentum, imparted by the Rotation of the Earth, gives to the upper stratum, in its flow from the Equator towards either Pole, an *easterly* direction, the *deficiency* of easterly momentum in the Polar under-flow, which is moving towards the Equator, will give it a *westerly* direction, so that it may be expected to be found approaching the surface on the western slopes of its basin.

#### 'CHALLENGER' TEMPERATURE-SURVEY OF THE ATLANTIC.

86. The Temperature-Survey of the Atlantic, which has now been carried out by the 'Challenger' in accordance with the instructions prepared by the Committee of the Royal Society nominated for the purpose of advising the Admiralty in regard to the work of the Expedition, may be truly characterised as the most important single contribution ever made to Terrestrial Physics; presenting, as it does, the whole *thermal stratification* of an Oceanic area, which may be roughly estimated at *fifteen millions of square miles*, with an average depth of *fifteen thousand feet*. This survey was made by means of "serial" Temperature-soundings at a number of different stations; the temperature, at each station, being ascertained at a number of different depths, usually at intervals of 100 fathoms down to 1500, and then at longer intervals to the bottom; and "bathymetrical isotherms" being drawn across the several Sections in accordance with these observations, at intervals of  $5^{\circ}$  (Fahr.) down to  $40^{\circ}$ , and below this at intervals of  $1^{\circ}$ ,—the descent of the thermometer beneath  $40^{\circ}$  being extremely slow.

87. The first Section (see Plate, No. I.) was taken obliquely across the North Atlantic, from Teneriffe (Lat.  $28^{\circ}$  N.) to St. Thomas's (Lat.  $18^{\circ}$  N.) between the 14th February and the 16th March, 1873. The depth progressively increased, with one remarkable exception, from 1890 fathoms at a short distance from Teneriffe, to 3150 fathoms at Long.  $35^{\circ}$  w., which was the greatest depth encountered in the Eastern basin. That exception was a rather sudden rise from 2000 to 1525 fathoms, at a distance of 160 miles s.w. of Ferro; and Captain Nares remarks,—“The rocky nature of the bottom, and the lowering of the temperature usual at that depth, would indicate a considerable movement of the lower stratum of water.” From Long.  $35^{\circ}$  w. to Long.  $44\frac{1}{2}^{\circ}$  w., the depth gradually diminished to 1900 fathoms; this submarine elevation, called the “Dolphin rise,” divides the Mid-Atlantic into an Eastern and a Western basin. The depth then gradually increased to 3025 fathoms, in Long.  $61\frac{1}{2}^{\circ}$  w., very near the northern extremity of the chain of the

Lesser Antilles or Windward Islands; and the water then rapidly shallowed as Sombrero Island was approached.

88. The Temperature Stratification is exactly conformable at its western end to the observations I had previously taken off the coast of Portugal, alike in regard to the position of the line of  $39^{\circ}$ , which was reached at 1000 fathoms, and in regard also to the progressive reduction below this to a bottom temperature of  $35\frac{1}{2}^{\circ}$ . But the temperature of  $50^{\circ}$  was encountered at a much smaller depth,—about 350 fathoms, instead of 700; so that the transition from  $50^{\circ}$  to  $40^{\circ}$  was much less abrupt than it was farther north. The uniformity of the depth, 380 fathoms, at which the temperature of  $49^{\circ}$  was reached, is a very remarkable feature in this section; especially when we bear in mind that its Western extremity is ten degrees farther south than its Eastern, and also that the spring was advancing. Thus, although the *surface*-temperature rose from  $65^{\circ}$  to  $76^{\circ}$ , the effect of this elevation was quite lost at a depth of 400 fathoms. Below this depth a remarkable change shows itself in the gradual upward slope of the isotherms of  $45^{\circ}$ ,  $40^{\circ}$ , and  $39^{\circ}$ ; so that the latter temperature, which was entered at the Eastern end at 1000 fathoms, is encountered over the deepest part of the Western basin at 850 fathoms, and the strata of  $50^{\circ}$ — $45^{\circ}$  and  $45^{\circ}$ — $40^{\circ}$  are by so much thinner. But the most significant phenomenon is the depression of the *bottom*-temperature from its remarkably uniform level of  $35^{\circ}.5$  in the deepest portion of the Eastern basin, to  $34^{\circ}.4$  in the deepest portion of the Western. This depression, taken in connection with other facts to be presently adduced, clearly indicates that an under-flow of *Antarctic* water extends as far north as St. Thomas's.

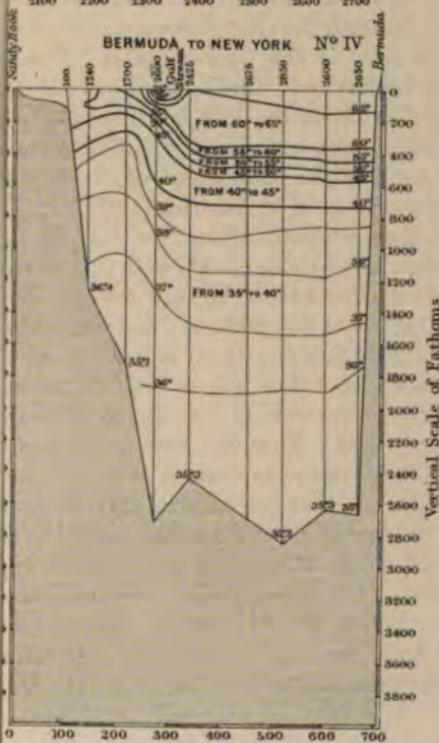
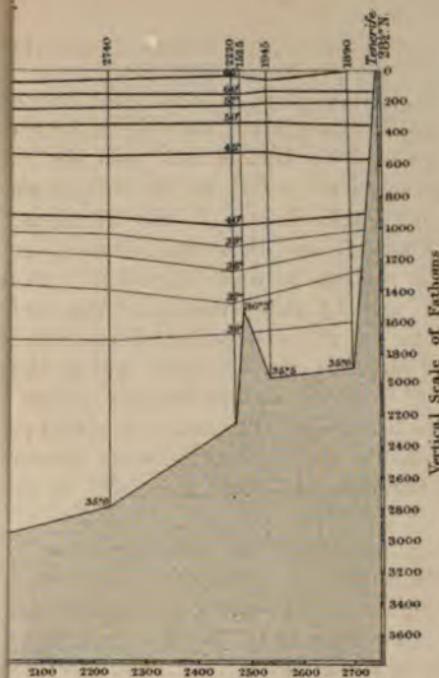
89. The 'Challenger' left St. Thomas's on the 24th March, and proceeded due north to Bermuda (Lat.  $32^{\circ}$  N.). At a short distance to the north of St. Thomas's (Plate, No. II.), an extraordinary depression of the bottom, to the depth of 3875 fathoms, was encountered. The details given by Captain Nares of this remarkable sounding—the deepest yet obtained on which reliance can be placed—leave no reasonable doubt of its trustworthiness; more especially when taken in connection with this significant fact, that the two "protected" Thermometers, which had previously stood the pressure of nearly *four tons* on the square inch, were both crushed by the pressure of  $4\frac{1}{2}$  tons which they here encountered, thus preventing the determination of the bottom-temperature. Past this depression, the bottom rose again to between 2800 and 2900 fathoms; and thence gradually to 2475 fathoms in the immediate neighbourhood of the Bermuda group, which seems to rest on a column nearly

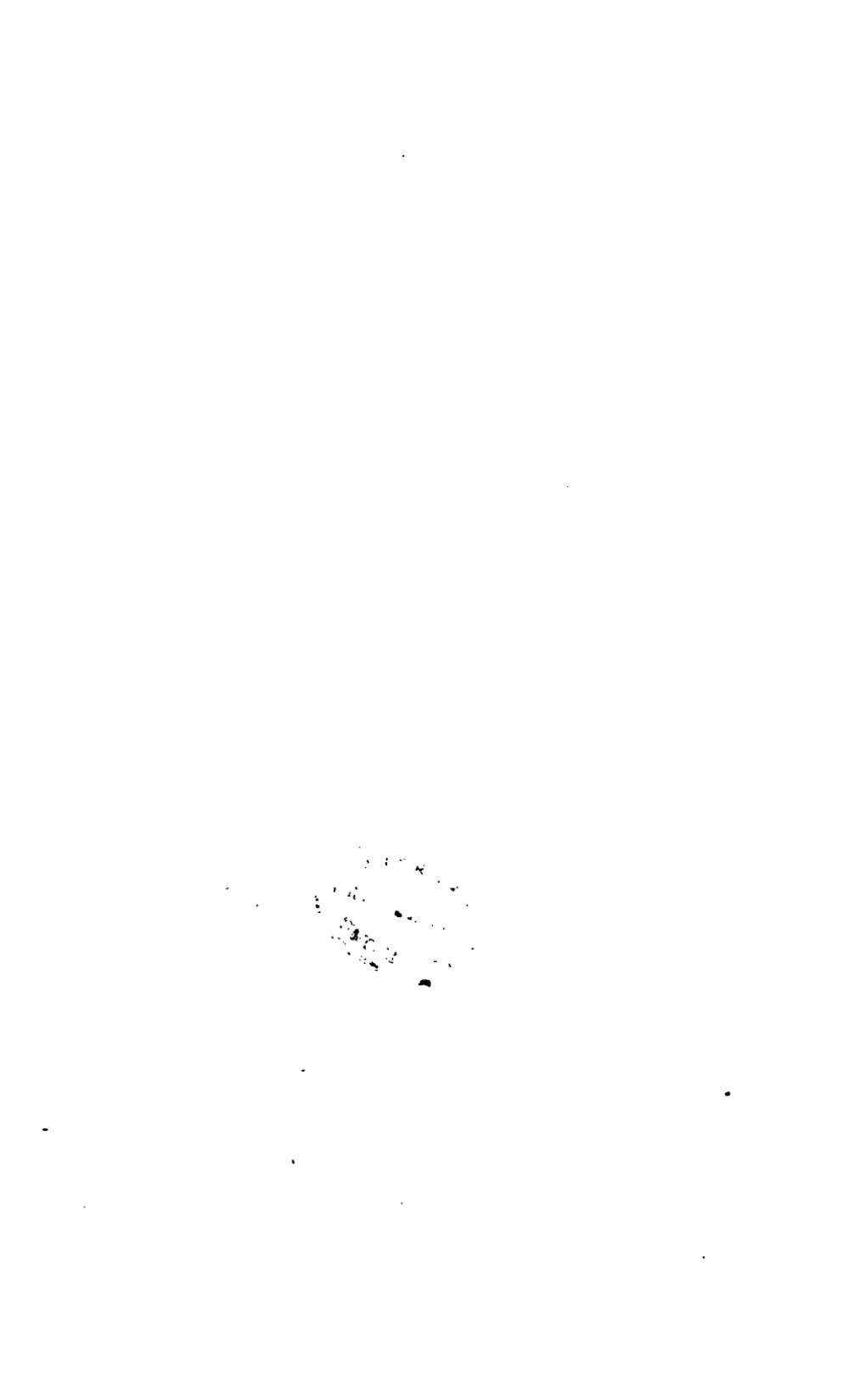
three miles high, rising from a very small base. There is strong reason to regard this column as a Coral-formation, commenced when the present deep bottom was near the surface, and kept up to it by progressive growth as the bottom gradually subsided.—The most noticeable feature in the Temperature-stratification between St. Thomas's and Bermuda, is the great increase in the thickness of the stratum between  $60^{\circ}$  and  $65^{\circ}$ ; this increase being produced, not only by the reduction of the surface-temperature, and the thinning-out of the superheated stratum, consequent upon the northward direction of the section; but by the lowering of the isotherm of  $60^{\circ}$  from 200 to 300 fathoms, though the isotherm of  $40^{\circ}$  rather rises than falls. The meaning of this peculiarity, which shows itself also in the Sections between Bermuda and Halifax, and between Bermuda and the Azores, will be presently inquired into (§ 93).

90. Leaving Bermuda on the 21st April, the 'Challenger' proceeded towards New York, crossing the Gulf-Stream, and carrying a line of Temperature-soundings to the edge of the shallow water off Sandy Hook. Immediately to the North of Bermuda, a depth of 2650 fathoms was met with; and this increased to 2850, still exceeding 2600 beneath the Gulf-Stream, and then rapidly diminishing towards the coast of the United States. Passing on thence to Halifax (Nova Scotia) the 'Challenger' arrived there on the 8th May; leaving it again on the 19th for Bermuda, where she arrived on the 31st, after again crossing the Gulf-Stream, and examining the singular temperature-phenomena of the "cold band" which separates it from the coast of America (§ 92).

91. In both these Sections (Plate, Nos. III., IV.), the condition of the *deeper* stratum corresponds closely with that previously described. From Bermuda northwards to the Gulf-Stream, the isotherm of  $40^{\circ}$  lies at a depth of about 650 fathoms; and below this to the bottom at from 2500 to 2800 fathoms, there is a progressive descent of the thermometer to a little below  $35^{\circ}$ , so that the thickness of the deep stratum having a temperature of from  $35^{\circ}$  to  $40^{\circ}$  averages about 2000 fathoms, or 12,000 feet. That the bottom-temperature is lower on the northern side of Bermuda than it is on the southern, may be taken as an indication that the influence of the Antarctic flow dies out a little to the north of St. Thomas's, while the like influence of the more limited Arctic flow shows itself as we approach Halifax. The upper strata here present some very singular features. The four successive layers,  $40^{\circ}$ - $45^{\circ}$ ,  $45^{\circ}$ - $50^{\circ}$ ,  $50^{\circ}$ - $55^{\circ}$ , and  $55^{\circ}$ - $60^{\circ}$ , are comparatively thin; so that a fall of no less than *twenty degrees* shows itself between about 340 and 620 fathoms. On the other hand,

Nº I





the layer whose temperature exceeds  $60^{\circ}$  has a greatly augmented thickness; the isotherm of  $60^{\circ}$ , which lay at 200 fathoms at St. Thomas's, here lying at about 330; notwithstanding a considerable reduction in the temperature of the *superficial* stratum, which makes the passage across the warm current of the Gulf-Stream the more obvious. It is perfectly clear from both the New York and the Halifax sections, that the *true* Gulf-Stream or Florida Current is a limited river of superheated water; of which the breadth is about 60 miles near Sandy Hook, whilst near Halifax it has separated into divergent streams forming a sort of delta; its depth (as determined by the use of the current-drag) being nowhere more than 100 fathoms. This river rests upon the remarkable stratum of  $60^{\circ}$ - $65^{\circ}$ ; the thickness of which, as we shall presently see (§ 93), distinguishes the Western from the Eastern Atlantic between Bermuda and the Azores; while at less than double the depth of that layer, we come into what is clearly Polar water.

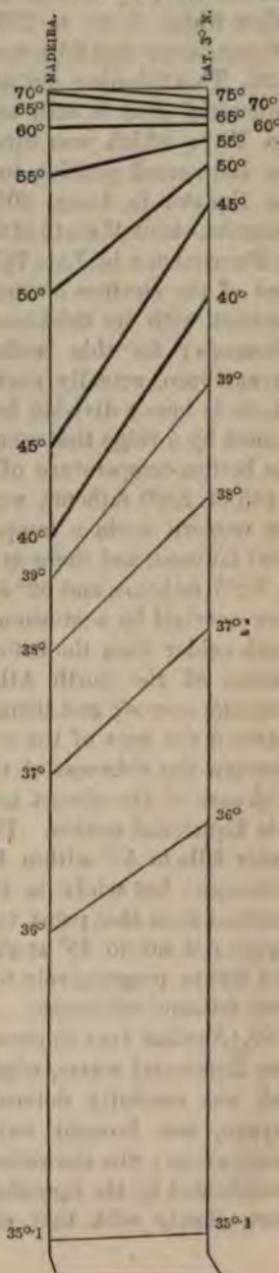
92. Now it has been long known that the Gulf-Stream is separated from the United States Coast by a band of water, of which the temperature is as much *below* the normal of the latitude, as that of the Gulf-Stream is *above* it; the passage from one to the other being so abrupt as to have been termed the "cold wall." And this band has been regarded as the continuation of the "Greenland and Labrador Current"; which, propelled by northerly winds, runs past Newfoundland, and then, turning the corner of Nova Scotia, passes across to Cape Cod, "hugs the shore" along the whole U.S. Atlantic seaboard, and extends even as far south as the Florida Channel itself. But of this southward extension of the Labrador Current there is no evidence whatever beyond that of *temperature*; no *surface-movement* being traceable in this cold band to the south of New York; and its existence has obviously been a perplexity to the U.S. Coast Surveyors, who traced its continuity with the cold stratum lying beneath the Gulf-Stream. This continuity comes out most remarkably in the 'Challenger' Temperature-section between the Gulf-Stream and Halifax; for we there see (not only as in the New York section) the bathymetrical isotherms of  $60^{\circ}$ ,  $55^{\circ}$ , and  $50^{\circ}$ , but the yet deeper isotherms of  $45^{\circ}$  and  $40^{\circ}$ , successively rising to the surface as we approach the land; while at a depth of only 83 fathoms a temperature of  $35^{\circ}$  is encountered, which, at no great distance to the south, would only be found at a depth of 2000 fathoms. This remarkable surging-upwards of the cold deep strata along the coast-line is in precise accordance with prediction (§ 85, i), and affords strong evidence that the whole glacial underflow has a *definite movement* towards the Equator (§ 104).

93. Leaving Bermuda June 12th, the 'Challenger' again crossed the Atlantic in an easterly direction, first passing slightly northwards (from Lat. 32° N. to 37½° N.) to the Azores, and then slightly southwards (from 37½° N. to 33° N.) to Madeira, where she arrived July 16th. The greatest depth met with between Bermuda and the base of the gradual slope which culminates in the Azores, is 2875 fathoms; and the lowest bottom-temperature is 35°. The most noticeable feature in this Section (Plate, No. V.), is the extension of the thick layer of 60°–65° as far eastwards as Long. 41° W.; and then its rapid thinning, by the approximation of the isotherm of 60° to the surface. At the same time, the isotherm of 40° gradually deepens; and the four intermediate bands resume nearly the same proportions that they presented in the eastern part of the section from Teneriffe to St. Thomas's. Thus it is obvious that there is a much larger quantity of heat in the upper 300 fathoms of the *western* half of the Atlantic, between about Lat. 25° N. and Lat. 40° N., than there is in the eastern; and it will be presently seen that this thick warm stratum is entirely wanting in the South Atlantic (§ 98). In Captain Nares's Report, it is spoken of as "a branch of the Gulf-Stream;" but I can see no evidence whatever that it has either entered or issued from the Gulf of Mexico; and if it be a part of the Trade-Wind Circulation at all, it is the reflux of that portion of the great Equatorial Current which does not enter the Caribbean Sea, but which, striking against the line of the West India Islands, the peninsula of Florida, and the coast of Georgia, is first deflected northwards, and then turns eastwards towards the Azores and the coast of Africa. Looking, however, to the depth of this stratum, which is three times as great as that of either the Gulf-Stream or the Equatorial Current that initiates it, and to the absence of evidence of its possession of any sensible motion, I find it difficult to see how its presence can be attributable in any considerable measure to the *horizontal* or Wind-circulation of the North Atlantic; and I would offer the following as a possible explanation of it:—The upper stratum of water under the Tropic of Cancer (which, for the reason already stated, § 85 h, is warmer than that of the Equatorial belt) is constantly receiving fresh heat from insolation, which will be carried by downward convection into a deeper subjacent stratum than it is in the Mediterranean (§ 36). Between the Tropic and Bermuda, the temperature of this stratum is not higher than the *isochelmal* of the latitude; that is to say, it is not different from that which an Inland Sea would have between the same parallels. And, on the hypothesis of a General Oceanic Circulation, the slow northerly movement of this warm

upper stratum would carry its sub-surface into higher latitudes. There is an obvious objection, however, to this *rationale*, in the fact that no such warm layer shows itself in the South Atlantic. But this may perhaps be met by the consideration that the upper stratum of the North Atlantic is not nearly as much cooled down by its limited Polar underflow, as that of the South Atlantic is by the vast movement of Antarctic water which is constantly taking place towards the Equator (§ 97). The lower temperature of the corresponding stratum in the *eastern* side of the North Atlantic basin, seems obviously due to the indraught along the coast of Portugal, Spain, and North Africa, which is required to supply the great Trade-wind Drift.—In whatever manner the presence of this vast body of warm water in the Mid-Atlantic is to be explained, we shall hereafter see that it has a very important influence on the amelioration of the climate of far-northern regions.

94. The next series of Temperature-observations was taken in nearly a north and south direction along the eastern border of the Atlantic, from Madeira to the Cape de Verde Islands, and thence to a position in Lat.  $3^{\circ}$  n. and Long.  $15^{\circ}$  w. The most noticeable feature in this Section, as shown in Diag. VI., was the progressive diminution in the thickness of the stratum above  $40^{\circ}$ , notwithstanding a progressive increase in the surface-temperature from  $71^{\circ}$  to  $79^{\circ}$ , consequent upon the approach to the Equator. Thus the isotherm of  $40^{\circ}$ , which at Madeira lies at about 900 fathoms' depth, and which halfway towards St. Vincent is in about 950

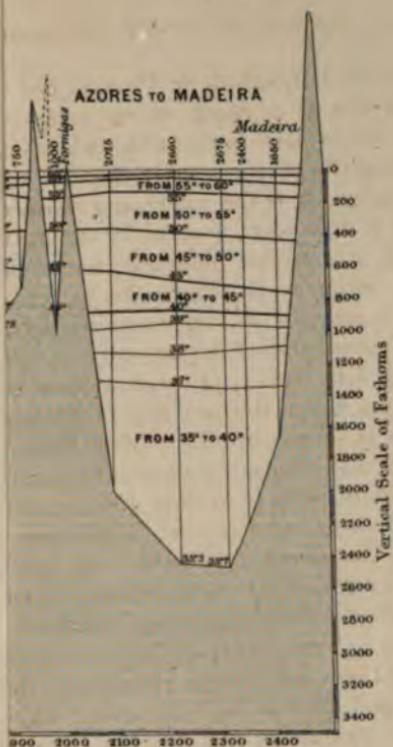
DIAGRAM VI.



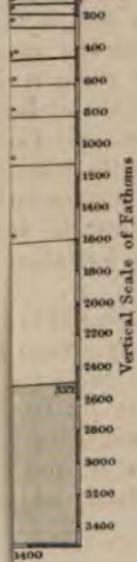
fathoms, rises to 650 fathoms at St. Vincent, and at the Equatorial position actually lies at a depth of no more than 300 fathoms, below which, down to 2500 fathoms, the whole under-stratum has a temperature that falls very gradually from 40° to 35°.

95. This thinning out of the upper and warmer stratum in the Equatorial zone is still more marked in the next Section (Plate, No. VI.); which was carried obliquely across the Equator from the last-named position to St. Paul's Rocks, which lie almost on the Equator in Long. 30° w., thence to the island of Fernando Noronha, about 4° south of the Line and in Long. 32 $\frac{1}{2}$ ° w., and thence to Pernambuco in Lat. 7 $\frac{1}{2}$ ° s.—Throughout this Section, the thinness of the stratum above the isotherm of 40° is in most striking contrast with its thickness in the Section from Teneriffe to St. Thomas's; for this isotherm, between Fernando Noronha and Pernambuco, actually rises to within 300 fathoms of the surface. There is here a division between the Eastern and Western basins, formed by a ridge that seems continuous with the "Dolphin Rise;" the bottom-temperature of the eastern basin, which has an average depth of 2500 fathoms, very closely approximates to 35°; but in the western basin a temperature of 35° is encountered at about 1800 fathoms, and there is a further progressive reduction to 33°.2 at 2275 fathoms, and 32°.4 at 2475 fathoms. Thus the bottom is here overlaid by a stratum of 600 fathoms' thickness, which is so much colder than the bottom-stratum of any but the Intertropical portion of the North Atlantic, as to be clearly derived from an *Antarctic* source; and there is nowhere a greater contrast, not only between the heat of the surface and the cold of the bottom, but between the thinness of the warm surface-film and the enormous thickness of the almost ice-cold body of water it covers, than in this Equatorial section. For from 78° at the surface, the thermometer falls to 55° within 100 fathoms, just as it does in the Mediterranean; but whilst in that Inland Sea the temperature remains constant from that point to the bottom, it goes on falling under the Equatorial sun to 45° at about 220 fathoms, to 40° at less than 300, and thence progressively to 32°.4 through a stratum of more than 2000 fathoms' thickness.

96. Another very important feature in the Physical condition of this Equatorial water, which was originally noticed by Humboldt, and was carefully determined by Lenz in Kotzebue's second voyage, was brought out very distinctly by the 'Challenger' observations; viz. the *reduction in the salinity* of the surface-water, as indicated by its Specific Gravity, so that it came to correspond more closely with that of the bottom-water, which it consider-



I  
Lat.  $3^{\circ} N.$   $\frac{3}{2}$  Long.  $15^{\circ} W.$   
FROM  $55^{\circ}$  to  $78^{\circ}$  AT SURFACE





ably exceeds in the tropical and extra-tropical portion of the North Atlantic. Thus the mean of eight observations between St. Thomas's and Bermuda gave 1·0272 as the Specific Gravity of surface-water, and 1·0263 as that of bottom-water; whilst the mean of seventeen observations on surface-water between the Cape de Verde Islands and Bahia gave a Specific Gravity of 1·0263, and a mean of eight observations of bottom-water a Specific Gravity of 1·0261. This, like the diminished thickness of the warm upper stratum, affords a very striking indication of the *ascent of bottom-water towards the surface*, which, on the theory of the Vertical Circulation, will take place in the Equatorial region, where the two Polar under-flows meet, while the warm upper layer is being constantly draughted off towards either Pole. And this is further indicated by the *low temperature* of Oceanic surface-water under the Equator, as compared with that of Inland Seas. For, notwithstanding that the sun is constantly shining down upon it in an almost vertical direction, the surface-temperature of the Equatorial Atlantic very little exceeds, at any period of the year, that which is seen in the water of the Eastern basin of the Mediterranean in the latter part of the summer (§ 34), and does not come near that often experienced in the Red Sea (§ 24).

97. Quitting Bahia September 25th, the 'Challenger' proceeded along the coast of South America to Abrolhos Island, in Lat. 20° s.; thence obliquely across the South Atlantic, to Tristan d'Acunha, in Lat. 36° s.; and thence nearly in the same parallel to the Cape of Good Hope, which was reached at the end of October. This Section (Plate, No. VII.), shows a well-marked division of the South Atlantic also into two basins; the island of Tristan d'Acunha being the culmination of a ridge which very probably extends northwards to the Dolphin Rise. The greatest depth met with in the Western basin was 2350 fathoms, and the lowest bottom-temperature 33°·1; the greatest depth met with in the Eastern basin was 2650 fathoms, and the lowest temperature 32°·9. It might have been expected that the bottom-temperatures in the western basin would have been lower, instead of higher, than those taken in the Equatorial section; since the glacial water of the latter must have reached it through some deep channel, probably not far from the coast of South America. The absence of any such indication, however, is readily accounted for by the fact, that circumstances prevented the Temperature-soundings in this basin from being taken at near intervals, some of them being as much as 600 miles apart; so that the required channel may well have lain between them. The existence of a more voluminous as well as colder under-flow than

that which reduces the temperature of the deepest parts of the North Atlantic basin, is evidenced by the fact that the isotherm of  $40^{\circ}$  lies in the South Atlantic at only about half the depth which it has in the North Atlantic between the same parallels; while the isotherm of  $35^{\circ}$  sometimes rises to 1500 fathoms, so that a stratum of water having a lower temperature (viz. between  $35^{\circ}$  and  $33^{\circ}$ ) than is found on the bottom of the North Atlantic between the same parallels, covers the sea-bed of the South Atlantic to the depth of 1000 fathoms or more.

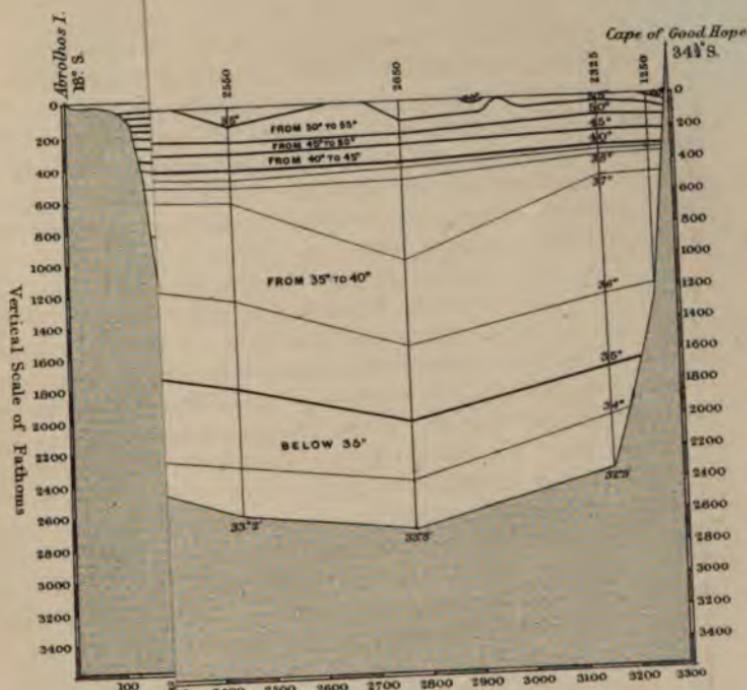
98. The upper portion of this Section is of much interest, as compared with that of the Equatorial section on the one hand, and with that of the North Atlantic sections on the other. As the distance from the Equator increased, the surface-temperature rapidly diminished, although the summer of the southern hemisphere was approaching; so that at Tristan d'Acunha the surface-temperature was only  $52^{\circ}$ . The descent from this point to  $40^{\circ}$  was not rapid, and was nearly uniform; the isotherm of  $40^{\circ}$  now again receding from the surface, and lying at a depth of from 400 to 500 fathoms. The excess of thickness of this upper warm stratum over that of the Equatorial zone, whilst the quantity of heat it contains is so much less, is a noteworthy fact; on the other hand, the inferiority of this stratum, alike in thickness and in the quantity of heat it contains, to that of the North Atlantic section at about the same distance from the Equator, is still more remarkable.

99. All these points are strikingly brought out in the accompanying Section, which I have constructed from soundings selected in such a manner as to combine in a nearly North and South direction (Plate, No. VIII.).

#### THERMAL STRATIFICATION OF THE ATLANTIC.

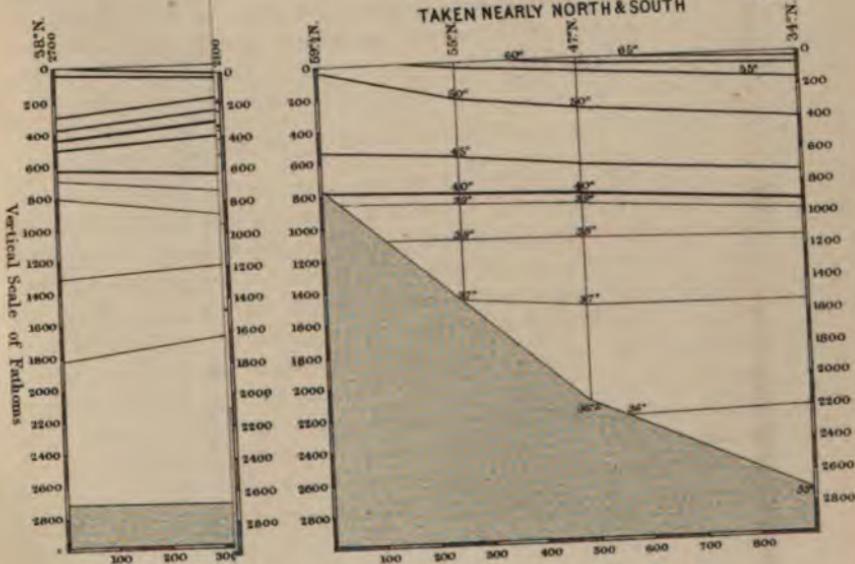
100. It has been already shown that in the interpretation of these phenomena, we are justified in assuming it as a principle based alike on theory and on observation,—that any water which is *colder* than the Isochimal (or lowest mean winter temperature) of the latitude, must have come from a source more distant from the Equator; and that if such water has a *glacial* temperature, it must have come all the way from one of the Polar areas. For suppose an area of (say) 100 miles in diameter to be enclosed in any part of the Atlantic by a circle of reefs rising up from the bottom to within 50 fathoms of the surface, we are fully justified by the thermal condition of the Mediterranean, of the Sulu Sea, and of the Red Sea, in affirming that the temperature of this area would

N° VII



SECTION OF NORTH ATLANTIC  
TAKEN NEARLY NORTH & SOUTH

N° IX





in winter be uniform from the surface to the bottom, and that in summer the superficial stratum alone would be superheated.

101. Now if such an area were so enclosed between St. Paul's Rocks and Fernando Noronha, its temperature would be certainly not less than  $75^{\circ}$ , and probably nearer  $80^{\circ}$ , from the surface to the bottom; but as we find that even at 100 fathoms it is at least  $20^{\circ}$  lower, at 240 fathoms  $30^{\circ}$  lower, at 320 fathoms  $40^{\circ}$  lower, and from 320 fathoms to the bottom at 2475 fathoms nearly  $45^{\circ}$  lower, we seem justified in saying with certainty (1) that almost the entire mass of water from 300 fathoms downwards must have come thither from a Polar source, and (2) that even the superficial stratum between 300 and 100 fathoms has had its temperature greatly reduced by admixture with Polar water.

102. Supposing, again, such an area to be secluded from the South Atlantic basin in the neighbourhood of Tristan d'Acunha, its uniform temperature from a small depth below the surface would be nearly  $60^{\circ}$ ; but since from 350 fathoms downwards the temperature is from  $20^{\circ}$  to  $27^{\circ}$  below this, we are fully justified in asserting that the subjacent stratum of more than 2000 fathoms' thickness must have come from a source much farther distant than the Equator.

103. If, lastly, our secluded area were midway between Bermuda and the Azores, we might expect to find its uniform temperature a little below  $60^{\circ}$ ; but on looking at the actual temperature (Sect. V.), we find that, after passing through the superheated stratum, we first come into one *above*  $60^{\circ}$ , which extends downwards to more than 300 fathoms' depth; and that the reduction to a temperature *below* the normal only shows itself below that depth. Here, on the same evidence that shows the *upper* stratum to have come from a *warmer* locality, we may conclude that the temperature of the *lower* stratum has been reduced by water coming from a *colder*.—As already pointed out (§ 93), the excess of *heat* in the *upper* stratum constitutes a difficulty on any hypothesis: that the *cold* of the *lower* is produced by an importation of Polar water, is now admitted on all hands.

104. That the deeper stratum of Atlantic water has a *definite movement*, however slow, towards the Equator, had been previously indicated by several facts. Thus it is well-known that icebergs occasionally cross the Gulf-Stream off the Banks of Newfoundland, and are carried to the south of it; and this can only be through the southerly movement of the deeper stratum in which the lower part of the mass is immersed, which carries it along against the counter-action of the upper current,—just as in the Black Sea Straits the

action of the under-current upon the current-drag suspended in it, drags inwards the suspending buoy, in opposition to the powerful outward surface-current in which it floats (§ 63). And so the buoy which was attached to the broken end of the Atlantic Cable of 1865, having got adrift, was found to have travelled nearly due south, a distance of 600 nautical miles in seventy-six days, in opposition to the Gulf-Stream; presumably by the action of the under-flow upon the long buoy-rope suspended in it.\*—But the 'Challenger' Temperature-sections afford another body of evidence to the same effect, which is not a little remarkable. For, as already pointed out (§ 92), they prove that continuity of the "cold band" separating the Gulf-Stream from the American sea-board, with the deep cold strata underlying the Gulf-Stream, which had been previously indicated by the U.S. Coast Surveyors; who had traced it out in the Florida Channel (where there is clear evidence of an inward under-current of glacial water, § 148), and to a certain depth also in other parts of its course. This "cold band" is clearly produced, therefore, by the surging-upwards of the deeper stratum of Atlantic water along the western slope of its basin. And an adequate *vera causa* for this surging-upwards is found in the Earth's rotation, if this stratum has a movement of its own from the Pole towards the Equator. For just as the Gulf-Stream, and the whole *north-moving* warm *upper-stratum*, constantly tend towards the *east*, in virtue of the *excess* of easterly momentum which they bring with them from a portion of the globe whose rotatory movement is *more* rapid, so the cold *under-stratum*, if moving southwards from a portion of the globe whose rotatory motion is *less* rapid, will bring with it a *deficiency* of easterly momentum, or, in other words, will tend towards the *west*.

105. This is by no means a solitary case. I have been informed by Captain St. John, who has been engaged for some years in the survey of the Japan Sea, that a similar "cold band" separates the Kuro Siwo (or warm Japan Current, sometimes called the "Gulf-Stream of the Pacific") from the eastern coast of Japan. And Dr. Meyer of Kiel, who has been for some time engaged in the examination of the physical condition of the Baltic, the North Sea, and their connecting channels, has communicated to me this remarkable fact:—While the greater part of the North Sea forms part of the platform, of less than 100 fathoms' depth, which surrounds the British Islands, and which serves as a coast-line to the glacial water lying at its northern edge at a depth of over 200 fathoms,

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\* 'Proceedings of Royal Geographical Society,' Jan. 9, 1871, p. 81, note.

there is a channel along the coast of Norway and Sweden which is deep enough to receive a cold stream from the Polar Sea; and this may be traced as far south as the Skager Rack. Now this cold stream surges-up on the western bank of its channel, and overflows the bed of the North Sea as far as the Dogger Bank; the temperature of whose eastern slope is thus reduced by from *ten to fifteen degrees* below that of the western, the difference being observable within very short distances, and at small changes of depth. This fully accounts for the fact mentioned to me by my friend Mr. J. Gwyn Jeffreys, that he has dredged Arctic shells upon the Dogger Bank.

106. Since, therefore, so many facts, otherwise quite anomalous, are found to be in such exact accordance with the general Doctrine, as to be predicable by an application of it to each particular case, and since the Doctrine itself has been pronounced by the greatest masters of Physical Theory to be in strict accordance with it, I submit that a strong claim has been now made out for its acceptance. If Lenz, nearly thirty years ago, combining the evidence afforded by the general prevalence of a Glacial temperature over the bottom of the great Oceanic basins, with the rise of the sub-surface isotherms beneath the Equator, and the low salinity of Equatorial water, could see no other explanation of these facts than that of a Vertical Circulation sustained by the constantly renewed difference of equilibrium between the Equatorial and Polar columns (§ 82), the conclusion at which he then arrived, confirmed as it is by such a large amount of additional evidence, may surely be now regarded as an established Doctrine of Terrestrial Physics.

#### RELATIVE THERMAL INFLUENCE OF THE GENERAL OCEANIC CIRCULATION, AND OF THE GULF-STREAM.

107. It has been shown (§ 95) that the General Oceanic Circulation exerts a most important influence in moderating what would otherwise be the unbearable heat of the Inter-Tropical Ocean. If there were no ascent of colder water from beneath, there seems no reason why the constant action of the powerful insolation to which Equatorial water is subjected, should not raise the temperature of its surface to the highest possible elevation. The limit to that elevation, which is obviously set by the cooling influence of evaporation, is probably that which we meet with in the Red Sea; where the highest temperatures are encountered when the enormous amount of vapour present in the air, by impeding further evaporation, restricts its cooling agency (§ 24). The same appears to be

the case along the Guinea Coast, and especially in the Bight of Biafra, where the surface-temperature is stated to range as high as 90°.\* But in these cases there is no reduction of surface-temperature by the upward movement of glacial water: which is altogether excluded from the Red Sea by the shallowness of the Strait of Babel Mandeb; whilst the depth of the bottom along the Guinea coast is too small to allow of its being overflowed by the glacial stratum (§ 74). In the Equatorial Mid-Atlantic, on the other hand, the temperature ranges but little either above or below 80°; and this constant moderation may fairly be attributed to that continual uprise of Polar water from beneath, which cannot any longer be regarded as theory, but must now take rank as a Physical fact. If it were not for this uprise, the surface-temperature of the Mid-Oceans under the Equator would be as high as that of the Red Sea at its hottest; since the atmosphere which overlies them is always so highly charged with vapour, as to render the cooling influence of evaporation far less than it exerts under the hot dry winds which have blown over arid deserts (§ 23).

108. I have now to inquire into the influence of this General Oceanic Circulation in moderating the Cold of the Polar areas; and, in particular, into its agency in producing that amelioration of the climate of North-Western Europe, which has been generally attributed to the Gulf-Stream.

109. In my former communication I endeavoured to show: (1) that there is adequate evidence that this amelioration depends on a *north-easterly flow of warm water*, and is not explicable (as Mr. Findlay, and subsequently Dr. Hayes have contended) by the prevalence of warm S.W. Winds; and (2) that this warm N.E. flow is far too deep and voluminous to be the continuation of the *true* Gulf-Stream or Florida Current, which I agree with Mr. Findlay and Dr. Hayes in regarding as (to use the language of Sir John Herschel) "dispersed and, in fact, destroyed" in the Mid-Atlantic "by the process of thinning-off and superficial extension." I shall now adduce a body of evidence which has subsequently accrued in support of both these propositions; which leaves (as it appears to me) no doubt whatever in regard to the *first*, and should satisfy everyone who is not "possessed" by a foregone conclusion, in regard to the *second*. This "possession" results, in great part, from an illogical confusion of thought, connected with an unscientific looseness in the use of language; for a comparison of the different senses in which the term "Gulf-Stream" has been used by

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\* See the 'Meteorological Committee's Current and Temperature Chart of the North Atlantic,' for April.

Physical Geographers, shows that scarcely any two of them really mean the same thing.\* I shall myself use it in its strict acceptation, as synonymous with the Florida Current.

110. Of a great general N.E. movement of North Atlantic water, carrying with it a temperature higher than the normal of the latitudes it reaches, we have additional evidence (*a*) in the results of the investigations carried on by the Scottish Meteorological Society, under the able direction of Mr. Buchan, in regard to the relative temperatures of the Sea and Air at different parts of the year, and the relation of the winter Isotherms of the British Isles to their Western coast-line; (*b*) in the results of the similar investigations of Professor Mohn, of Christiania, upon the very peculiar climate of Norway; and (*c*) in the temperature-observations recently made in the Arctic Sea, between Iceland and Spitzbergen. Of each of these I shall now give a brief summary.

111. The careful correlation made by the late Dr. Keith Johnston and Mr. Buchan, of the observations on Sea-temperature which have now been carried on by the Scottish Meteorological Society through a lengthened term of years, has established the fact that on the West coast of Scotland, the *mean annual* Temperature of the Sea is from *two to three degrees higher* than that of the Air; and this mean annual excess represents a very much larger *winter* excess, as is best shown by grouping the months as follows:—

May, June, July, August, average excess of *air-temperature*  $2^{\circ}1$ .

March, April, September, October, average excess of *sea-temperature*,  $2^{\circ}3$ .

November, December, January, February, average excess of *sea-temperature*,  $6^{\circ}2$ .

Nearly the same results have been obtained from observations carried on at Thorsavn (Faroe): while in Iceland the mean annual excess of the Sea-temperature is rather higher; not so much, however, from increase of the winter excess, as from the absence of the summer reversal; the sea having then the same temperature as the air, or being even a little warmer. Again, it has been shown by Mr. Buchan that while the *summer* Isotherms cross the British Islands in lines generally corresponding with the parallels of Latitude (*i.e.*, nearly East and West), the *winter* Isotherms pass through England and Scotland in a nearly meridional direction (*i.e.*, nearly North and South); the January isotherm of  $39^{\circ}$  passing from Uist along the western coast of Scotland, and then through the centre of England to Hastings; the isotherms of  $40^{\circ}$  and  $41^{\circ}$  lying parallel

\* See my Report for 1871, in the 'Proceedings of the Royal Society,' for June 13, 1872, pp. 592-608.

to it on the western side, and those of  $38^{\circ}$  and  $37^{\circ}$  showing a like parallelism on the eastern; whilst in Ireland, the isotherms "seem to envelope the island with their folds, which increase in warmth from the centre of the island outward to the ocean."\* Nothing could more conclusively prove the dependence of our mild Winter climate upon the proximity of a Sea which is warmer than the superincumbent Atmosphere.

112. But this evidence is still stronger in the case of Norway; the peculiar climatic condition of which has been carefully studied by Professor Mohn, the able director of the Meteorological Institute.† For the excess of the mean annual temperature of the Sea above that of the Air, shows itself more and more strongly as we go northwards; being greatest at Fruholm, near the North Cape, where the mean annual excess of  $6^{\circ}1$  is made up by an average excess for the four Winter months of  $14^{\circ}5$  (that of December alone being nearly  $17^{\circ}$ ), for the four Spring and Autumn months of  $6^{\circ}3$ , and for the four Summer months of  $2^{\circ}6$ . It is this flow of warm water, as Admiral Irminger had previously remarked, which keeps open the Norwegian harbours though the whole winter, even beyond the North Cape. And its influence on the Climate of the interior of Norway is demonstrated by the parallelism of the Isothermal lines to the coast-line, not only in Winter but also in Summer—the temperature *falling* as we pass inland in January, but *rising* as we pass inland in July.

113. That the influence of this flow extends also to Iceland, and to the Sea between Iceland and Spitzbergen, has been shown by Admiral Irminger.‡ "The warm current which passes Cape "Reikianüs, and runs to the northward along the western shores of "Iceland, is the cause of the south and west coasts of this island "being clear of ice, so that even during the severest winters ships "may go to Havne Fiord and other places in the Faxe Bay of "Iceland, where they will always be sure of finding open sea. If "this current to the North in the Atlantic did not exist, the ice "from the sea round Spitzbergen would float down to more southern "latitudes than is now the case; and certainly the coast of Norway, "as well as the sea between Shetland and Iceland, would frequently "be filled with ice from the Icy Sea, and the influence of the ice "would then be felt on the climate of the neighbouring coasts." What Admiral Irminger here terms a "current," however, I should rather call a "set;" for, from his discussion of the reckonings kept

\* 'Journal of the Scottish Meteorological Society,' vol. iii., 1871.

† 'Die Klimatologie Norwegens.' Von H. Mohn, Christiania, 1872.

‡ 'Proceedings of the Royal Geographical Society,' May 10, 1869, p. 227.

by ships of the Danish Navy, in their passages to and from Iceland, he estimates the rate of the movement at from 0·8 to 4·7 miles per day. That it is not a mere superficial drift, but a deep voluminous flow, will presently appear.

114. Independently of this general N.E. movement, the temperature-observations which have been correlated by Admiral Irminger,\* and another series more recently collected and correlated by Professor Mohn of Christiania,† indicate that the Ocean-surface is traversed by bands of somewhat greater warmth. Admiral Irminger specially notes the existence of two such bands,—one of them a little to the west of Fair Isle, which is regarded by Dr. Keith Johnston and Mr. Buchan (on the basis of Professor Mohn's data) as the axis of this "slow current," its temperature being sensibly higher than the temperature to the west or east of it; whilst the other, the position of which is more variable, is met with much further to the westward, sometimes even beyond the meridian of the southernmost point of Iceland.—These bands, the existence of which has been lately confirmed by Von Middendorf (§ 117), are regarded by Admiral Irminger (as it seems to me with great probability) in the light of real continuations of the "Gulf-Stream proper," which are not only deflected northwards, but also carried onwards by the general N.E. "set."

115. That this "set" extends *all across* the North Atlantic from Newfoundland to Galway—a breadth of more than 1700 miles—is clearly shown by the course of the Isothermal lines laid down in Dr. Petermann's Gulf-Stream Charts for January and July (see CHART). The summer Isotherms of  $54\frac{1}{2}^{\circ}$ ,  $50^{\circ}$ , and  $45\frac{1}{2}^{\circ}$ , turn sharply northwards to the east of the Bank of Newfoundland: diverging from one another and from the summer Isotherms of  $60^{\circ}$  at intervals which are pretty nearly equal almost as far to the East as the meridian of  $30^{\circ}$  w.; but then again trending strongly to the North, so that the summer Isotherm of  $54\frac{1}{2}^{\circ}$  crosses the parallel of  $60^{\circ}$  n. before, by a slight trend to the South, it passes through the Pentland Firth. Thence crossing the North Sea, this Isotherm passes along the coast of Norway as far as Tromsö (very near the parallel of  $70^{\circ}$ ), and then turns southwards along the land, keeping within the coast-line of Russian Lapland, and passing across the narrow throat of the White Sea. The summer Isotherms of  $50^{\circ}$  and  $45\frac{1}{2}^{\circ}$  cross the mouth of Baffin's Bay, and then follow the curve of the coast of Greenland towards Iceland; when approaching which they turn eastwards,

\* 'Journal of the Royal Geographical Society,' vol. xl. (1870), p. 441.

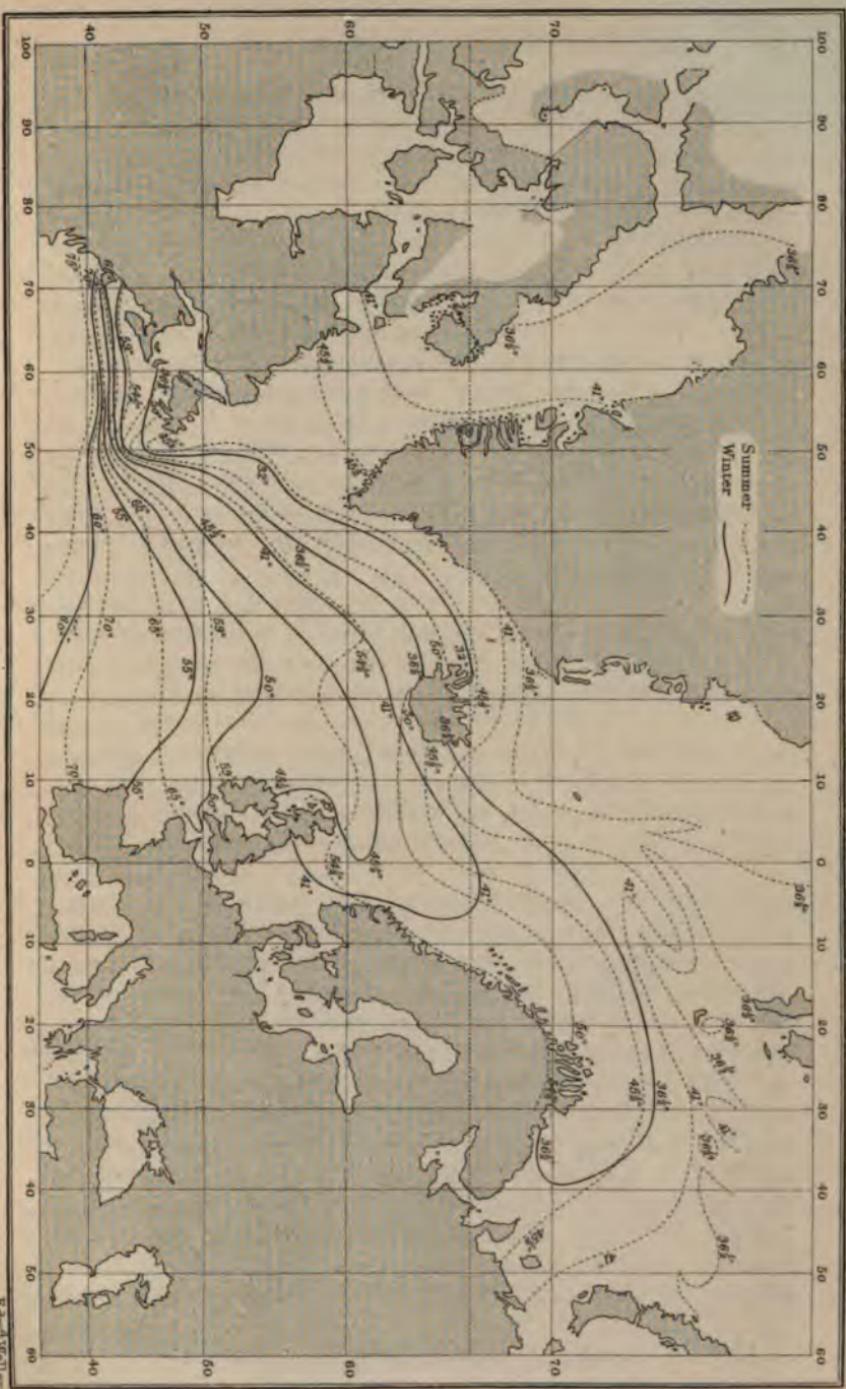
† 'Température de la Mer entre l'Islande, l'Écosse, et la Norvège.' Christiania, 1870.

the line of  $50^{\circ}$  striking the land at Stykkisholm on the N.W., while the line of  $45\frac{1}{2}^{\circ}$  passes altogether to the north of the island. To the east of Iceland the Isotherms take a southerly bend, apparently under the influence of a drift of ice from the Polar Sea, but soon turn northwards again; the line of  $50^{\circ}$  running nearly parallel to the coast of Norway as far as the North Cape, and then turning southwards along the coast of Russian Lapland, so as to cross the mouth of the White Sea to the base of the Kanin Peninsula; while the line of  $45\frac{1}{2}^{\circ}$  runs parallel to this as far north as Lat.  $72\frac{1}{2}^{\circ}$ , and then turns southwards, still retaining the same parallelism, so as to strike the coast of Russia beyond that peninsula. Still further north, we find the summer Isotherms of  $41^{\circ}$  and  $36\frac{1}{2}^{\circ}$  showing a nearly W. to E. direction until they have passed the meridian of  $10^{\circ}$  w., and then suddenly turning northwards; the line of  $36\frac{1}{2}^{\circ}$  passing up to the west of Spitzbergen as far as  $82^{\circ}$  n., and also extending itself irregularly eastwards along the parallel of  $75^{\circ}$  as far as Nova Zembla.

116. The course of the winter Isotherms of  $45\frac{1}{2}^{\circ}$ ,  $41^{\circ}$ ,  $36\frac{1}{2}^{\circ}$ , and  $32^{\circ}$ , as shown in Dr. Petermann's Chart, is no less significant; for they all turn sharply to the North on the eastern side of the Banks of Newfoundland, cross the entrance of Baffin's Bay, and then keep a course of general parallelism to the coast of Greenland, crossing the meridian of  $30^{\circ}$  w. at almost equal intervals. The winter Isotherm of  $45\frac{1}{2}^{\circ}$  follows almost exactly the course of the summer Isotherm of  $54\frac{1}{2}^{\circ}$  as far as the Shetland Islands: but it then turns back on itself so as to form a loop, passing southwards along the Western Hebrides towards Belfast. The course of the winter Isotherm of  $40^{\circ}$  in like manner at first bears a general correspondence with that of the summer Isotherm of  $50^{\circ}$ , skirting the south coast of Iceland, and then passing N.E. in the channel between Iceland and Norway; but in Lat.  $67\frac{1}{2}^{\circ}$  n. it also returns in a loop, which brings it back to the east coast of Scotland. The winter Isotherm of  $36\frac{1}{2}^{\circ}$ , again, corresponds very closely with the summer Isotherm of  $45^{\circ}$ ; passing through Iceland, and then keeping a N.E. course which carries it far to the north and east of the North Cape, when it, too, forms a loop bringing it back to the coast of Russian Lapland. Finally, the winter Isotherm of  $32^{\circ}$  proceeds along a similar course from the Banks of Newfoundland to the northernmost point of Iceland, and then onwards towards Jan Mayen, beyond which it has not been traced.

117. That this remarkable course both of the Summer and of the Winter Isotherms can only be accounted for by a N.E. flow of warm water, I am as strongly convinced as Dr. Petermann can be:

ISOTHERMALS OF THE NORTH ATLANTIC & POLAR SEA [AFTER DR. PETERMANN]





and that this movement must be something very different from a mere surface-drift, seems to me equally certain; since, unless the warm stratum is of considerable depth, it could not possibly retain that excess of temperature which it carries with it into higher latitudes (§ 122).—Further evidence to the same effect has been supplied by the recent observations made by Von Middendorf in the Voyage of the Russian Corvette 'Warjäg,' between Archangel, Iceland, and Nova Zembla, in the summer of 1870;\* of which the following are among the most important:—

a. The existence of *alternating warm and cold bands*, as affirmed by Admiral Irminger, was confirmed. On the 17th of June, 1870, a temperature of  $55^{\circ}6$  was observed off the coast of Norway, north of  $60^{\circ}$ : and in July a temperature of  $54\frac{1}{2}^{\circ}$  was observed in N. Lat.  $69\frac{3}{4}^{\circ}$  nearly in sight of the islands off Tromsö, in N. Lat.  $64^{\circ}$  in the roads of Reikiavik, and in N. Lat.  $61\frac{1}{2}^{\circ}$  on the meridian of the centre of Iceland. On the other hand, near the Lofoten Islands the surface-temperature fell to  $47^{\circ}$ ; and a minimum of  $42^{\circ}1$  was observed in N. Lat.  $64\frac{1}{2}^{\circ}$ .

b. The *thickness of the warm stream* is shown by the fact that in N. Lat.  $69\frac{1}{2}^{\circ}$  and W. Long.  $14^{\circ}$ , the surface-temperature being  $50^{\circ}7$ , the temperature at 40 fathoms was found to be still  $46^{\circ}4$ , and at 84 fathoms  $45^{\circ}5$ .

c. The North-Cape stream, hardly perceptibly cooled from  $54^{\circ}5$ , runs past the White Sea and the Kanin Peninsula towards the entrance of the Kara Sea; so that in the vicinity of Kolgujev Island (N. Lat.  $68^{\circ}$ ) there are still bands which have in July nearly the same temperature.

d. On the meridian of the Kanin Peninsula, the North-Cape stream, which may be there called the Kanin stream, has a breadth of more than  $2^{\circ}$  of Latitude, with a range of temperature between  $55^{\circ}$  and  $47^{\circ}7$ . The higher the temperature is on the surface, the more rapidly does it fall beneath it; but at 30 fathoms it is still between  $42^{\circ}$  and  $38^{\circ}7$ . The Kanin stream appears to divide at Nova Zembla; its main branch going onwards into the Kara Sea, whilst a side branch turns northwards along the west coast of Nova Zembla. Another portion, however, striking against the Kanin Peninsula, seems to turn inwards along the east coast of the White Sea, the temperature of which is moderated by it (especially with N.E., N. and N.W. winds) as far as Dwina Bay. The western coast of the White Sea, on the other hand, is bordered by a cold stream, the temperature of which is probably the local temperature

\* 'Geographische Mittheilungen,' Jan. 1871.

corresponding to the region. Thus, in passing round Cape Swätoi at the beginning of July, the thermometer fell to  $42^{\circ}6$ , and further south to  $39^{\circ}9$ ; whilst a month later,  $1\frac{1}{2}$ ° further north, on the same meridian, the temperature was  $51^{\circ}1$ .

e. It is considered by Von Middendorf that "the Gulf-Stream "can still be detected at Kolgujev, not only by the temperature, but "also by the blue colour and high salinity of the sea."—"We sailed "there through water of so deep a violet-blue, that I was confident "of finding it swarming with microscopic animalculæ and plants. "My astonishment was great when I could not detect anything "under the microscope."—As this distinctive blue colour has not been observed in the North-Cape stream, I should be disposed to attribute it to the diffusion of the fine sedimentary particles brought down by the Dwina and Mezen rivers (see § 39, note). The Specific Gravity of the water of the Kanin stream being only 1·025, it is high only in relation to that of the water of the White Sea, which is reduced by the large quantity of river-water discharged into it. At Cape Swätoi, which does not lie in the supposed Gulf-Stream, the Specific Gravity of the water was found to be 1·026.

f. The Zoological researches of Th. Jarshinski (1869) along the Murmanian (N.E. Lapland) coast of the Polar Sea, are stated by Von Middendorf to prove the affinity of its Fauna with that of the Atlantic Ocean.

g. The remarkable agreement of the temperature of the Air with that of the Water, and the manifest dependence of the temperature of the Air on that of the Water, induce Von Middendorf to adopt, without hesitation, the doctrine of direct heating by warm water. "We should have been able," he says, "to determine by the "temperature of the Air, without ascertaining that of the Water, "whether we were or were not within the warm water of the extension of the Gulf-Stream. The direction of the wind had evidently "but a subordinate influence on the temperature of the Air."—It is expressly stated by Von Middendorf, that when speaking of "currents" he does not intend to imply more than the result of Temperature-observations, which indicate a flow of warm water from the west.

118. The Temperature-observations recently made by Messrs. Weyprecht and Payer in still higher Northern Latitudes, show that *this warmer surface layer rapidly thins off towards the north-east*; and that instead of a *rise* of Temperature with increase of depth in the Polar area (which is the doctrine still maintained by many Physical Geographers), there is a rapid *reduction*,—glacial water

being found at a less and less depth in proportion to the northing obtained.

Lat. 72° 30' N. Long. 44° E.			Lat. 76° 40' N. Long. 55° E.			Lat. 77° 26' N. Long. 44° E.		
Depth.	° Fahr.	Depth	° Fahr.	Depth	° Fahr.			
12 to 114 feet ..	40·6	6 to 36 feet ..	36·5	6 to 36 feet ..	36 to 35·2			
		48 "	33·8	45 "	32·5			
		60 "	32·0	60 "	32·5			
		72 "	30·9	75 "	30·6			
		90 "	30·6	90 "	30·4			
144 " ..	36·5	120 "	29·7	120 "	29·1			
174 " ..	35·6	180 "	29·8	180 "	28·8			
234 " ..	34·3							
294 " ..	32·9	300 "	29·8					
360 " ..	32·9	" ..	" ..	360 "	29·1			
450 " ..	32·0							
600 " ..	31·3							
800 " ..	29·7							

"The transition of the water from the higher to the lower temperature," they say, "is, near the northern limit, a very rapid one, and nearly everywhere occurs in closest proximity to the ice, so that we were able in the thickest fog to run close up to the barrier under the guidance of the thermometer."\* These results are in general accordance with those obtained by Mr. Leigh Smith in his two voyages to Spitzbergen in 1872 and 1873,† and also with those of M. Charles Martins, which have effectually disposed of the notion that the deeper water of the Polar Sea is *warmer* than the superficial. It is quite true that the *surface*-water is often found to be *colder* than the stratum which immediately underlies it, the temperature of the former being reduced by the melting of the ice, whilst the colder water continues to float in virtue of its inferior salinity. But the warmer *sub-surface* stratum may now be affirmed with certainty to lie upon a bed of glacial water, the temperature of which has been found in some instances to descend as low as 25°.‡

119. Further, the observations collected by Dr. Mühry,§ relating to the Temperature of the Western coast of Greenland, seem to

\* 'Geographische Mittheilungen,' 1872, p. 70.

† The temperatures taken in 1872 were communicated to the Royal Society by Captain Wells, R.N. ('Proceedings,' Dec. 19, 1872, p. 91); those taken in 1873 have been kindly supplied to me by Lieut. Chernside, R.E. The former series contain the extraordinarily *high* temperature of 64°; in the latter, the extraordinarily *low* temperature of 22° at a depth of 500 fathoms was recorded. It seems to me far more likely that the thermometer-index had been displaced in both these cases, than that temperatures so anomalous should actually exist.

‡ A valuable summary of all the observations taken up to 1868 on deep Polar temperatures, is given in the elaborate Memoir lately presented by Mr. Prestwich to the Royal Society.

§ 'Geographische Mittheilungen,' 1854, p. 187.

indicate a northward flow of comparatively warm water along that side of Baffin's Bay, in antagonism to the Polar current which flows southwards on the Labrador side. It is certain that the climate of the south-western coast of Greenland is much milder than that of either its eastern coast or the eastern coast of Labrador under the same parallels: and the summer Isotherm of  $41^{\circ}$  is carried northwards in Dr. Petermann's Chart nearly as far as Upernivik, while the summer Isotherm of  $36\frac{1}{2}^{\circ}$  extends in  $70^{\circ}$  W. Long. to Smith's Sound, as in  $10^{\circ}$  E. Long. it extends to Spitzbergen. According to Admiral Irminger, a distinct current can be traced as far north as Lat.  $64^{\circ}$  or even  $67^{\circ}$ ; and this brings with it *Mimosa* and other tropical products,—such as a mahogany log, found on Disco Island, which was made into a dining-table for the Governor of Holsteenborg. Moreover it has been noticed by several trustworthy observers, that icebergs often move *northwards* in Davis's Straits, in opposition to a *southerly* moving surface-current, as also against the wind. This warmer north-flowing body of water is assumed by Dr. Mühry to be a branch of the "Gulf-Stream;" but how the *vis à tergo* of the Florida Current can propel it up Baffin's Bay, making it turn round the corner of Newfoundland from its previous due East to a North-west direction, I am entirely unable to comprehend.

120. This seems to me, indeed, a sort of *reductio ad absurdum* of the loose mode of reasoning by which the flow of warm water along the North-West and North coast of Europe has come to be regarded as evidence of the extension of the Florida Current into the Arctic area. Because a body of water warmer than the normal can be shown to arrive at the western shores of Ireland, Scotland, and Norway, and to flow eastward along the north coast of Russia, this (it is represented) must be a continuation of the "Gulf-Stream;" which yet, on evidence that no one has been able to dispute, has lost (to use the words of Dr. Hayes), before reaching the meridian of  $30^{\circ}$  W. Long., every distinctive character as a current: "first, "in rate of flow, which has become that of the general easterly 'set' "of the Atlantic; second, in temperature, which has become that "of the general temperature of the air; third, in colour of water, "which has lost the blue that it had when emerging from the Gulf of "Mexico; in everything, in fact, which goes to make up what we "designate as an 'ocean-current.'" The general easterly "set," according to the Admiralty Chart, prevails over the whole area of the Atlantic between the parallels of  $43^{\circ}$  (Cape Finisterre) and  $55^{\circ}$  (Belfast), taking a more northerly direction in still higher latitudes. Its usual rate appears to be from 6 to 24 miles per day,

varying with the degree in which the westerly "Anti-trades" predominate in force and duration over other winds. That it is essentially independent of the Gulf-Stream, seems to be distinctly indicated by the fact that it commences from the very edge of the Arctic current, on the Eastern side of the broad band which it covers, as far as  $10^{\circ}$  to the north of the Gulf-Stream, running parallel to its course. Although mainly due to the dominant influence of the "Anti-trades," yet it may be partly accounted for, on the doctrine of a general northward movement of the whole upper stratum, by the excess of easterly momentum which this north-moving water will carry with it. That this is in great part the explanation of the easterly direction finally taken by the true Gulf-Stream, is now generally admitted; and it applies with still greater force to any flow which extends up into higher latitudes, where the length of the degrees of longitude rapidly diminishes. For as *two* degrees of longitude in Lat.  $60^{\circ}$  are equal in round numbers to *three* degrees in Lat.  $70^{\circ}$ , and to *six* degrees in Lat.  $80^{\circ}$ , the north-moving water which is being carried round by the Earth's rotation in Lat.  $60^{\circ}$  at the rate of about 520 miles an hour, would bring with it into Lat.  $70^{\circ}$  an excess of easterly momentum (if none were lost on the way) of about 170 miles an hour, and would carry with it a like excess in flowing northwards from Lat.  $70^{\circ}$  to Lat.  $80^{\circ}$ . Hence the steady *easterly* set of the warm stratum along the north coast of Russia, even as far as Nova Zembla, can be fully accounted for, if adequate reason can be found for its *northward* flow; and for the latter, as already shown, the doctrine of a general Oceanic Circulation affords a satisfactory *vera causa*. This general north-easterly movement, moreover, especially when coupled with the prevalence of S.W. winds over the north-east portion of the North Atlantic area, fully accounts for the further transport of floating bodies which have been brought into the mid-Atlantic by the true Gulf-Stream; and the fact that these are carried rather to the West of Ireland, the Hebrides, the Orkney, Shetland, and Faroe islands, and even to Spitzbergen, than in that direct easterly course towards the Bay of Biscay which the Gulf-Stream has when it ceases to be recognisable as a distinct current, seems a clear indication that their transport over the latter part of their course is essentially due, as was long ago suggested by Sir Edward Sabine,\* to the predominance of South-westerly winds over

\* The note appended by Sir Edward Sabine to the passage of Humboldt's "Cosmos" which unhesitatingly expressed the then prevalent doctrine of the Gulf-Stream, distinctly marks his scepticism as to the derivation of the flow of warm water to the North Cape of Europe, from the current passing out through the Florida Channel.

this portion of the area of the Atlantic.—It is well remarked by Dr. Hayes, that just as a ball fired from a cannon stationed on the top of a hill loses its velocity with every second of its progress, and falls to the earth when its impelling force is exhausted, but may still roll down hill by the force of gravity, which is a new power applied to it; so may Gulf-Stream water, and anything which it floats, be drifted onwards by the action of the wind, after its original *vis à tergo* has died out.

121. I shall now endeavour to show that the warm flow, which constitutes the real ameliorator of the climate of North-Western Europe, is far too deep and voluminous to be derived from the true Gulf-Stream (see APPENDIX III.) It is just as clear that in the neighbourhood of the Faroe Islands, the temperature of the upper stratum down to at least 600 fathoms is *above* the normal, as we have seen it to be (§ 101) that the temperature of the deeper stratum nearer the Equator is *below* the normal. For if we could imagine a marine area to be here so secluded, that its temperature should depend on only local agencies, the thermometer, after passing through the variable surface-stratum, would show a uniform temperature of between 35° and 40°, corresponding to the *isochial* of the region. But the *actual* temperature is several degrees above this; for between 50 and 600 fathoms the thermometer only sinks from 48° to 43°; and on combining into one section the temperatures taken in the 'Porcupine,' between the Faroe Islands and the coast of Portugal (Plate, p. 362, No. IX.), it becomes obvious that there is a continuity of the whole upper stratum between these two points, as shown by the slightness of the change in the position of the bathymetrical isotherms of 45° and 40°, notwithstanding the reduction of surface-temperature. This continuity, by which a body of water that is *below* the normal off the coast of Portugal, comes to be *above* the normal off the Faroe Islands, seems plainly to point to a *northward movement of the whole upper stratum* as its cause; and this view is fully accepted by two of the principal upholders of the Gulf-Stream doctrine, Dr. Petermann and Professor Wyville Thomson. The former admits that this deep warm voluminous flow is only in part derived from the Florida Current, which he regards as receiving numerous tributaries; but he does not attempt to show how the thinned-out expansion of the Florida Current, even when reinforced by these tributaries, can put in motion a stratum of water at least 3000 feet thick, extending all across the North Atlantic. The latter continues\* to uphold the

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\* 'The Depths of the Sea,' chap. viii.

doctrine which I quoted and contested in my former communication (p. 77), as to the re-collection, in the *cul de sac* of the Northern Atlantic, of the portion of the Florida Current which does not turn southward round the Azores; but he does not attempt to show how the stream which has, when it runs past New York, at the rate of three miles an hour, a breadth of 60 miles and a depth of 100 fathoms, can, after encountering the Arctic Current off Newfoundland, and being broken up into bands of small depth, the direction of whose movement (when it is last perceptible) is *nearly due east*—tending to return *southwards* into the general horizontal circulation round the Sargasso Sea,—can impart a *northward* movement to a mass of water 1700 miles wide (§ 115), and 600 fathoms deep. To me it seems that the surface-isotherms of Dr. Petermann, which show the vast *breadth* of this north-moving warm stratum, and the bathymetric isotherms of our ‘Porcupine’ soundings, which mark its great *depth*, really prove far too much. For if the Gulf-Stream spreads itself out so much as to give that northward movement to the whole breadth of the North Atlantic which is indicated by Dr. Petermann’s isotherms, how can it possibly have the depth of the warm flow which is shown in our Section, and which is necessary to enable it to maintain its heating power? If, on the other hand, its re-collection in a *cul de sac* gives it the depth of 600 or 700 fathoms, how can it possibly have a breadth of 1700 miles? But if we look upon the Poleward movement of the thick warm upper stratum, as the necessary complement of the movement of the glacial underflow towards the Equator, the whole difficulty vanishes; every fact is accounted for by an adequate *vera causa*; and while the agency of the true Gulf-Stream, in bringing into the Mid-Atlantic a body of warm water which does more than neutralize the depression that would otherwise be produced by the Greenland and Labrador Current, bearing its fleet of icebergs, is not ignored, the transport of North Atlantic water to the Polar area is assigned to the General Oceanic Circulation.

122. A little consideration will show that such a deep movement of moderately warm water is far more effectual as a *heater*, than a surface-movement of much warmer water. For the latter, when it passes beneath an atmosphere much colder than itself, will soon be brought down to a like standard, not having warmer water from beneath to take its place when it has been cooled down; just as we find the temperature of the superheated layer of water in the Mediterranean, which overlies water of  $55^{\circ}$ , closely following that of the air, between the summer and winter mean. But in the former case, each surface-layer, when cooled below the temperature of the warmer

stratum beneath, will sink, and be replaced by it; and this slow cooling process will go on, until the entire mass has lost its surplus heat, and has been brought down to the temperature of the atmosphere. And I entirely agree with Mr. Findlay that the known facts as to the depth and rate of motion of the *true* Gulf-Stream, when it is last distinguishable as a current, make it perfectly clear that, long before it reaches the British Isles, it must have been brought down to the temperature of the air above it. We have seen, on the other hand, that the less heated but thicker stratum carries an excess of warmth far within the Arctic Circle (§ 117).

123. But while the General Oceanic Circulation thus mitigates alike the otherwise unendurable severity of Polar Cold and the intolerable fierceness of Equatorial Heat, it exerts, in combination with the Earth's rotation, another very important influence on Terrestrial Climate; since, on the principle already explained (§ 104), while it will always tend to carry against the *western* shores of Continents the warm upper stratum which is slowly flowing from the Equator towards either Pole, it will also cause the deeper and colder stratum to surge-up against their *eastern* shores. This effect is subject to great local modification by Wind-currents; and will, of course, be most conspicuous where it is aided by their surface-movement, and be least obvious where the surface-movement tends to antagonize it. Of the former case, we have a most conspicuous example in the condition of the East coast of Greenland, where the almost constant prevalence of northerly and north-easterly winds comes in aid of the upward tendency of the glacial underflow, to keep it almost constantly blockaded by ice. And the cold surface-current thus driven south, reinforced by that which issues from Baffin's Bay, forms the Labrador current, which is continued southwards as the United States Coast current, the movement of which is perceptible as far south as Cape Hatteras. But south of this there is still a "cold-band" separating the Gulf-Stream from the shore-line; and the existence of this, as already pointed out (§ 92), marks the surging-upwards of the deeper stratum. On the other hand, the western coasts of South Africa and South America have their temperature kept down by surface-currents bringing cold water from the far south; these being partly in draught-currents for the supply of the great Equatorial stream that is put in motion by the Trade-Winds, alike in the Atlantic and in the Pacific Ocean, but partly owing their movement to the Winds that prevail over their own line of flow. These form part of that horizontal Wind Circulation, which can be traced in every great Ocean as a result of the movement of air over its surface; and the influence of which on

the distribution of Temperature I do not for a moment call in question, whilst maintaining that there are phenomena for which it does not and cannot account.

124. The question naturally arises why the Climatic modification produced by the General Oceanic Circulation should be so much more marked in the Northern than it is in the Southern Hemisphere. This seems to depend mainly upon the comparative limitation of the passages between the Arctic basin and the great Northern Oceans; whilst between the Antarctic and the great Southern Oceans there is an unrestricted communication. We have seen that this has the effect, not merely of lowering the bottom-temperature, but of bringing a much larger body of Polar water into the South Atlantic basin (§ 97); so that the isotherm of  $40^{\circ}$  lies in every part of it much nearer the surface, than it does in the North Atlantic even as far north as the Faroes. The superiority of the North Atlantic in the warmth of its upper stratum, becomes most marked when we compare with the Section of the South Atlantic (No. VII.), not the Teneriffe and St. Thomas's Section (No. I.), which shows the influence of the up-rise of Arctic water under the Equator, but the Bermuda and Halifax (No. III.), and Bermuda and Azores Sections (No. V.), which show that further north the warmth of the upper stratum is greater than it is in the neighbourhood of the Tropic of Cancer. Hence, if the Poleward flow which ameliorates the climate of North-Western Europe, were derived directly from the *tropical* portion of the North Atlantic, it would not have a much more powerful effect than a flow towards the Antarctic area proceeding from the tropical portion of the South Atlantic. But derived as it is from the warmer stratum of N. Lat.  $35^{\circ}$ - $40^{\circ}$ , it carries with it a much greater heating power. While admitting it as an arguable hypothesis that this Poleward flow owes its peculiar warmth to the Wind-circulation of the North Atlantic, yet I would still have it kept in view that what I called in my former communication (§ 20) the *neutral region* of the North Atlantic, from which that flow is immediately derived, may be considered to have a temperature nearer the normal than that of any other part of the basin. Lying beyond the influence of the great Antarctic underflow, it is subject only to the limited influence of the glacial flow from the Arctic basin. And its thermal power begins to manifest itself sensibly along our Western shores, as soon as it has been carried far enough to the northward for the temperature of its sub-surface stratum to be above that of the atmosphere: and here, again, the prevalence of South-westerly winds comes in aid of the General Oceanic Circulation, in carrying the warm surface-stratum against the shores

of the British Isles and the coast of Norway, and in diminishing that reduction of its temperature which its passage into a much higher latitude would otherwise produce.—The question stands much in need of further elucidation; and much new light will probably be thrown upon it by the Temperature-survey of the other great Ocean-basins, which the 'Challenger' is charged to carry out: in particular, from the comparison of the thermal stratification of the North Pacific, which receives no glacial underflow from the Arctic basin, with that of the South Pacific, which, like the South Atlantic, is freely open to the Antarctic underflow.

125. *Influence of the General Oceanic Circulation on the Distribution of Animal Life.*—Of the influence of the General Oceanic Circulation upon the Temperature of the Deep Sea-bed, it is impossible to speak in exaggerated terms: for it is obviously the one thing by which the Temperature of the sea-bottom, and consequently the distribution of Animal life, is essentially determined. In all the great Ocean-basins yet examined, the temperature at depths of 2000 fathoms or more is within a few degrees of  $32^{\circ}$ ; the closeness of the approximation being proportional to the freedom of communication which the particular basin has with the Polar areas. And thus it becomes obvious that the prevalence of a Glacial temperature over the Oceanic sea-bed is essentially independent of the conditions which determine Terrestrial climate. If the Antarctic continent which formerly connected South America, New Zealand, and Australia, were again to shut off the south Polar area from the Southern Oceans, the bottom-temperature of each would rise in a degree depending on its seclusion from the Arctic underflow. Thus we might imagine the Indian Ocean to be converted into a vast Inland Sea, with a bottom-temperature almost as high as that of the Mediterranean. The Atlantic would still receive the glacial streams which come down from the North Polar basin; but the cooling influence of these would be diminished by their extension into its Southern basin, which would then be warmer instead of colder than its Northern. And the Pacific, which at present only communicates with the Arctic basin by a Strait too shallow to allow of any outflow of glacial water, would not have its bottom-temperature reduced below the *isochemal* of its own coldest portion. Further, as the elevation of the present Sea-bed of even the Intertropical Oceans would offer to the study of the Geologists of the future a deposit characterised by the presence of Polar types of Animal life, so must the Geologists of the present refrain from regarding the occurrence of Boreal types in any *marine* deposit, as adequate evidence *per se* of the extension of glacial action into Temperate or Tropical regions.

126. But it is not alone in determining the distribution of Temperature, that the General Oceanic Circulation affects the distribution of Animal life; for its influence in carrying down material for the Nutrition, and in sustaining the Respiration, of the inhabitants of the Deep Sea-bed appears to me equally important. I have already stated that in my two exploratory visits to the Mediterranean, I was struck with the contrast afforded by the almost entire absence of Animal life at depths below 300 fathoms, and the abundant Fauna we had met with in the Atlantic at several times that depth (§ 39). This limitation has also been observed by Oscar Schmidt in the Adriatic; and it corresponds with the results obtained in the Ægean by Edward Forbes, whose limitation of Animal life to that depth, therefore, was perfectly correct as regards that Inland Sea, though not true of the great Oceanic basins.—Now, on trying to reason out the cause of this absence of Animal life, I came to the conclusion that it lay essentially in the stagnation of the whole of the deeper portion of the Mediterranean; the entrance of Atlantic water affecting only its surface-film, and the uniformity of its Temperature from 100 fathoms to the bottom preventing it from having any Thermal Circulation of its own. Thus the Organic matter which is brought into this basin by its great rivers, and which is gradually subsiding with the fine mud that is everywhere settling down on its sea-bed, uses-up in its decomposition any Oxygen which the water may contain, leaving little or none for the support of Animal life. In the open Ocean, on the other hand, *every drop of water will, in its turn, be brought up from its greatest depths to the surface, by the Vertical Circulation*; and so, by prolonged exposure to the air, will get rid of its excess of Carbonic acid, and take in a fresh supply of Oxygen; which, by its Polar descent, it will carry to abyssal depths,—thus serving, like the respiratory movements of the higher animals, for the renewal of the Respiratory medium which aerates the animal fluids.

127. The same agency that provides abyssal animals with Oxygen, serves also to supply them with Food. In all our dredging explorations, the entire absence of Vegetable life below about 300 fathoms (the stony Nullipores alone extending to that depth) was a conspicuous fact. And the question forced itself upon our consideration, “On what do the abyssal animals live?” Of course, if they could only live on one another, they would in no long time come to an end. There must be somewhere a manufacture of Organic matter for their sustenance.—This problem is of more direct importance to Man, than might at first sight be supposed. Our fishing-vessels resort to the Faroe Banks for Cod, to be used as

an article of human food. These banks swarm with a particular kind of Star-fish, on which the Cod feed largely, as is known by an examination of the contents of their stomachs; these Star-fish, in their turn, feed upon the Globigerinæ which cover the North Atlantic sea-bottom, as is known by an examination of the contents of *their* stomachs. Thus these Globigerinæ are not only making Chalk for the men who may be alive when the bed of the Atlantic shall be heaved up into dry land; but they are helping to manufacture Cod-fish for the men of the present generation. But upon what do the Globigerinæ themselves feed? This question was answered with scientific correctness, as I believe, by Professor Wyville Thomson: who pointed out that the superficial stratum of Ocean-water is continually acquiring Organic matter from the Vegetation of its shallower stratum, of which we have a special example in the case of the vast floating meadow known as the Sargasso Sea; and the presence of this Organic matter, in a condition fit for the maintenance of Animal life, has been determined by chemical analyses made under the careful superintendence of Dr. Frankland.\* These analyses showed its diffusion through deep as well as through shallow Ocean-waters; and for this diffusion the general Oceanic Circulation affords the required instrumentality.

128. Thus, I venture to think, under every point of view, the Doctrine I advocate is one not merely of speculative or even of purely scientific interest, but of the highest practical importance; and if the further results of the 'Challenger' explorations prove to be as confirmatory of it as are those which I have now discussed, I cannot but believe that it will gain the universal acceptance of competent and unprejudiced judges. To complete the investigation, however, it is essential that a Temperature Section should be carried across the deep channel which separates Iceland from Greenland, and also across the mouth of Baffin's Bay, in order to ascertain the thickness of the glacial underflow which they bring down from the Polar basin; and the gradual thinning-out of this, as it diffuses itself over the Sea-bed of the North Atlantic, should also be traced out.

129. It will further be extremely important to ascertain whether this Glacial underflow has a movement of which the direction and rate are determinable by Mechanical means. And I would specially point out that the "Lightning Channel" (§ 77) affords a peculiarly favourable opportunity for such investigation, in consequence of the well-marked distinctness of its two strata. If my view be

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\* 'Proceedings of the Royal Society,' Nov. 18, 1869, p. 483.

correct, a "current-drag" suspended in the *upper* stratum ought to have a perceptible movement in the N.E. direction; whilst another, suspended in the *lower* stratum, should move S.W. And though the *rate* of movement in each may be very slow, yet the opposition of their *directions* may be expected soon to make itself apparent, in the separation of the surface-buoys from which the drags are suspended.—That the low temperature of from  $32^{\circ}$  to  $29\frac{1}{2}^{\circ}$ , which prevails over the bottom of this Channel, can only be maintained by a *continued flow* of the glacial under-stratum from N.E. to S.W., appears to me so obvious on the general grounds stated in my former communication (§ 37), that I feel greatly surprised that my colleague in the survey of it, Prof. Wyville Thomson, should continue to represent this Glacial stream as "banked up" by the warm stream which comes up from the S.W. in the contrary direction.\* The two streams press against each *laterally*, like the Arctic current and the Gulf-Stream, so as to form a "cold wall" in the S.W. portion of the Channel; as is perfectly clear from the way in which the warm stream there covers a part of the bottom, forming the "warm area" that lies in close proximity to the "cold area" covered by the Glacial underflow. But in doing this, so far from checking the cold underflow, the warm stream obviously increases the rate of its movement,—just as the rate of the Gulf-Stream is increased where the Arctic Current impinges upon it (§ 156): this increase being marked by the *rounding* into pebbles of what was elsewhere angular gravel, and by the mounting of the deep stratum under  $33^{\circ}$  *up an incline*, so as to come much nearer the surface than where the bottom is deeper,—exactly as in the Florida Channel (§ 178). This is proved by a comparison of the Temperatures taken in two Serial soundings, given in my former communication ('Proceedings Royal Geo. Soc.', 1871, p. 79). For it there appears that at the southern of these two Stations (No. 52), which was near the Faroe Banks, while the surface-temperature was higher than at the northern (No. 64), and the isotherm of  $40^{\circ}$  lay deeper, the deep cold stratum came up so much nearer to the surface, that the passage from the one to the other was more abrupt,—the thermometer there falling from  $38^{\circ}4$  at 250 fathoms to  $30^{\circ}8$  at 300, and to  $30^{\circ}6$  at 350; whilst at the northern station the temperature was  $32^{\circ}4$  at 300 fathoms, and  $31^{\circ}$  at 400 fathoms, only falling to  $30^{\circ}6$  at 450 fathoms, thus distinctly indicating a *movement* of the deep glacial flow *up the slope*. That we did not trace the outflow of this cold stream into the great basin of the Atlantic,

\* 'Depths of the Sea,' p. 400.

Captain B. F. Austin, the specific gravity of  
the sea could have entirely ignored my own mer-  
itless attempts on this subject. *Proceedings*,  
vol. xii., 1870, pp. 194 et seq., and 1871, p. 142.  
Levantine, number of samples of its water  
at various points of the surface, and from various  
depths downwards to 1743 fathoms. These were almost  
all from the Western basin, but the deepest sample  
was from the Eastern basin, about 10 miles beyond Mala.  
The specific Gravity of each was obtained at the time,  
and the amount of chlorine was determined by Volumetric  
analysis, which can be readily carried on aboard ship; and from  
this the proportion of salt may be estimated with consider-  
able accuracy. The physical and the chemical method of ascer-  
taining the salinity of each sample gave results which generally  
agreed very closely. The range of specific gravity was from  
1.0292 to a minimum of 1.0268. But there was so  
little difference in Salinity between surface-water and bottom-  
water, measured alike by specific gravity and by chlorine determinations,  
the results of the two series of observations need to  
be separated:—

Surface-water.			Bottom-water.	
Sp. gr.	Cd. temp.		Sp. gr.	Chloride.
1.0278	20.87	..	1.0285	21.38
1.0284	21.32	..	1.0292	21.88
1.0265	20.70	..	1.0281	21.08

maximum Salinity having first presented itself at moderate depths in the Western basin, it was expected, when greater depths were attained, that the bottom-water would prove yet more dense. This, however, was not found to be the case; for the greater the depth, the less was the excess in the salinity of the bottom-water. In the 1743 fathoms' sounding, the specific gravity of the water being 1.0281, that of the bottom-water was only 1.0275. On grouping all the observations on the salinity of bottom-water indicated alike by specific gravity and by the proportion of marine, into three series, according to depth, the following result was arrived at:—

		Grav.	Sp. gr.
400, Mean of 7 observations .. .. ..	21.53	1.0287	
" " 7 .. .. ..	21.58	1.0285	
" " 6 .. .. ..	21.52	1.0283	

appears that the excess of Salinity is greatest in the  
and that it gradually *diminishes* with the depth.  
most strikingly by comparing the sample taken

from the *least* depth (207 fathoms) with that taken from the greatest depth (1703 fathoms); for it was the former that showed the *maximum* of 21·88, and the latter that showed the *minimum* of 21·08. Now, if we consider the mode in which the concentration of the surface-films by evaporation will affect the water below, we find that the surface-water thus rendered heavier will *not* gravitate to the bottom, but will diffuse itself through the subjacent stratum. For experiment shows that if a strong saline solution, tinged with colour, be poured upon the top of a weaker colourless solution, though the former will in the first instance sink "bodily," it will gradually impart its excess of salt to the liquid through which it falls; the descent of the coloured stratum becoming slower and slower, and its colour being more and more imparted to the general mass of the liquid; so that the proportion of salt is in time rendered uniform throughout the whole column by diffusion. Hence it is obvious that if each column rests (so to speak) on its own base, the degree in which the Salinity of the whole mass will be raised by the addition of a more concentrated solution, will be in the inverse proportion to its height; and thus where the depth of the Mediterranean basin is only between 200 and 400 fathoms, we might expect the specific gravity of its water to be more raised by the successive concentration of its surface-films, than where the depth ranges from 1300 to 1700 fathoms,—*as proves to be actually the case.*

135. In my *second* visit to the Mediterranean, I verified this result by Specific-Gravity observations in the Eastern basin; which showed that, with a general higher range of specific gravity (as Forchhammer had previously observed), the excess of Salinity in *bottom*-water over that of the *surface* is only marked where the bed is shallow. Thus, the specific gravity of a sample of *bottom*-water brought up from a depth of 2000 fathoms, at about 100 miles to the east of Malta, was 1·0291, while that of the *surface*-water was 1·0288. In a sounding taken eight days afterwards, not far from the Gulf of Solloom on the Libyan coast, the density alike of bottom and of surface water was found still greater; the specific gravity of the *bottom*-water obtained from a depth of 1650 fathoms being 1·0294, while that of the *surface*-water was 1·0293. But in another sounding, taken nearer the coast of Africa, the density of the *bottom*-water at a depth of 365 fathoms was found to be much more in excess of that of the *surface*-water; the specific gravity of the former being 1·0302, while that of the latter was only 1·0294. These results agreed in a very marked manner with those just cited from the researches of the previous year in the Western basin, as to the fact of the *excess* in Salinity of *bottom*-water over *surface*-water being

the older observations of Captain Spratt on the specific gravity of Mediterranean water, should have entirely ignored my own more recent and far more extended inquiries on this subject ('Proceedings of the Royal Society,' 1870, pp. 198 *et seq.*, and 1872, p. 582). In my *first* visit to the Mediterranean, numerous samples of its water were collected from various points of the surface, and from various depths, ranging downwards to 1743 fathoms. These were almost entirely obtained from the Western basin; but the deepest sample was taken from the Eastern basin, about 60 miles beyond Malta. Not only was the Specific Gravity of each ascertained at the time, but the proportion of chlorine was determined by Volumetric analysis, which can be readily carried on aboard ship; and from this the entire proportion of salt may be estimated with considerable exactness. The physical and the chemical method of ascertaining the density of each sample gave results which generally accorded very closely. The range of specific gravity was from a maximum of 1·0292 to a minimum of 1·0268. But there was so marked a difference in Salinity between surface-water and bottom-water, as indicated alike by specific gravity and by chlorine determinations, that the results of the two series of observations need to be presented separately :—

	<i>Surface-water.</i>		<i>Bottom-water.</i>	
	Sp. gr.	Chlorine.	Sp. gr.	Chlorine.
Average .. ..	1·0278	20·87	.. ..	1·0285 21·38
Maximum .. ..	1·0284	21·32	.. ..	1·0292 21·88
Minimum .. ..	1·0265	20·70	.. ..	1·0281 21·08

133. The maximum Salinity having first presented itself at moderate depths in the Western basin, it was expected, when greater depths were sounded, that the bottom-water would prove yet more dense. This, however, was not found to be the case; for the *greater the depth, the less was the excess* in the salinity of the bottom-water. Thus in the 1743 fathoms' sounding, the specific gravity of the surface-water being 1·0281, that of the bottom-water was only 1·0283. On grouping all the observations on the salinity of bottom-water, as indicated alike by specific gravity and by the proportion of chlorine, into three series, according to depth, the following curious result was arrived at :—

Fathoms.		Chlorine.	Sp. gr.
200 to 400, Mean of 7 observations .. ..	.. ..	21·53	1·0287
400 " 800 " 7 "	.. ..	21·38	1·0285
1300 " 1700 " 6 "	.. ..	21·21	1·0283

134. Thus it appears that the excess of Salinity is greatest in the shallower water, and that it gradually diminishes with the depth. This is also shown most strikingly by comparing the sample taken

from the *least* depth (207 fathoms) with that taken from the greatest depth (1703 fathoms); for it was the former that showed the *maximum* of 21·88, and the latter that showed the *minimum* of 21·08. Now, if we consider the mode in which the concentration of the surface-films by evaporation will affect the water below, we find that the surface-water thus rendered heavier will *not* gravitate to the bottom, but will diffuse itself through the subjacent stratum. For experiment shows that if a strong saline solution, tinged with colour, be poured upon the top of a weaker colourless solution, though the former will in the first instance sink "bodily," it will gradually impart its excess of salt to the liquid through which it falls; the descent of the coloured stratum becoming slower and slower, and its colour being more and more imparted to the general mass of the liquid; so that the proportion of salt is in time rendered uniform throughout the whole column by diffusion. Hence it is obvious that if each column rests (so to speak) on its own base, the degree in which the Salinity of the whole mass will be raised by the addition of a more concentrated solution, will be in the inverse proportion to its height; and thus where the depth of the Mediterranean basin is only between 200 and 400 fathoms, we might expect the specific gravity of its water to be more raised by the successive concentration of its surface-films, than where the depth ranges from 1300 to 1700 fathoms,—*as proves to be actually the case.*

135. In my *second* visit to the Mediterranean, I verified this result by Specific-Gravity observations in the Eastern basin; which showed that, with a general higher range of specific gravity (as Forchhammer had previously observed), the excess of Salinity in *bottom-water* over that of the *surface* is only marked where the bed is shallow. Thus, the specific gravity of a sample of *bottom-water* brought up from a depth of 2000 fathoms, at about 100 miles to the east of Malta, was 1·0291, while that of the *surface-water* was 1·0288. In a sounding taken eight days afterwards, not far from the Gulf of Solloom on the Libyan coast, the density alike of *bottom* and of *surface water* was found still greater; the specific gravity of the *bottom-water* obtained from a depth of 1650 fathoms being 1·0294, while that of the *surface-water* was 1·0293. But in another sounding, taken nearer the coast of Africa, the density of the *bottom-water* at a depth of 365 fathoms was found to be much more in excess of that of the *surface-water*; the specific gravity of the former being 1·0302, while that of the latter was only 1·0294. These results agreed in a very marked manner with those just cited from the researches of the previous year in the Western basin, as to the fact of the excess in Salinity of *bottom-water* over *surface-water* being

greatest where the depth is small ; and the fact, of course, becomes yet more significant, when the general increase of Salinity is so marked. There appears, then, no reason to doubt the explanation already offered,—viz. that, supposing an equal degree of concentration by surface-evaporation to take place in two or more equal areas, the increase in the salinity of the entire column of underlying water will be inversely proportional to the height of that column : for the diffusion of equal amounts of concentrated water through columns whose heights are in the proportion of 1, 2, 3, will raise the specific gravity of these columns respectively in the proportion of 3, 2, 1 ; the *shortest* column being *most* affected, while the *longest*, in which the same amount of concentrated water is diffused through three times the quantity, has its density but little raised.

136. Thus, therefore, Mr. Laughton is incorrect in asserting that the water concentrated by surface evaporation would “sink placidly into the *holes* ;” for theory and observation alike show (1) that it tends to diffuse itself downwards through the subjacent column ; (2) that this diffusion is checked on the shallower bottoms, where the increase of salinity shows itself very sensibly ; and (3) that it does *not* extend to the deepest parts of the basin, where the salinity does not sensibly exceed that of the upper stratum, the excess being draughted off before it reaches the “holes.” From these shallower bottoms, and from the upper stratum of the deeper parts of the basin, the more saline water can as readily find its way over the “bank” between the Eastern and the Western basins, as it has been shown to do over the “ridge” between the Western basin and the Atlantic (§§ 52–54).

#### APPENDIX II.—OBJECTIONS TO THE DOCTRINE OF A THERMAL OCEANIC CIRCULATION.

137. The doctrine of an Oceanic Circulation, sustained by opposition of Temperature alone, has been vigorously opposed by Mr. James Croll, in a series of papers on the Physical Cause of Ocean Currents, published in the ‘Philosophical Magazine.’ For the reason already given (§ 84), I do not think it needful to prolong the discussion of the Physical Theory on which it rests ; and would simply request anyone who may doubt the correctness of the principles with which I started (§§ 1–7) to try the experiment of applying Cold to the surface of water at one end of a long trough (Fig. 1). For he will find, by making use of a colouring liquid, that a “vertical circulation” will be immediately initiated ; the water beneath the surface-cold at once descending to the bottom, and giving rise to a *bottom-flow* towards the opposite end of the trough, whilst an equivalent *surface-*

flow takes place towards the end at which the cold is applied. To sustain this circulation, Heat must be applied at the opposite end, otherwise the whole water in the trough will be progressively cooled down. The adequacy of the cause, however, supposing it to operate as I affirm, is disputed by Mr. Croll, on the ground that, as the utmost difference in downward pressure which can be now made out to exist between the Polar and Equatorial columns, is not more than the equivalent of 10 feet of sea-water, it is quite preposterous to suppose that so small a force should put in movement a deep outflow of Polar water reaching to the Equator. Taking his stand upon the experiments upon the motion of water along channels, made by M. Dubuat, who found "that when the inclination was 1 in 500,000, the motion of the water was barely perceptible," and "that when the inclination is reduced to 1 in "1,000,000, all motion ceases," Mr. Croll maintains that as the inclination afforded by the difference of temperature between the sea in the Equatorial and Polar regions does not equal one-third of this, it can have absolutely no effect whatever in producing movement. But the experiments of M. Dubuat had reference, not to a slow restoration of equilibrium produced by the motion of water on itself, but to the sensible movement of water flowing over solid surfaces and retarded by its friction against them; and I have the authority of Mr. Hawksley (whose large experience in the construction of Waterworks enables him to speak with high authority on this point) for the statement, that whilst the latter source of retardation is one with which Hydraulic Engineers are well acquainted, the friction with which the former is attended is so slight that it is altogether disregarded in practice. According to Mr. Croll, if a trough of a length more than 1,000,000 feet long were filled with water, and the density of the column at one end were increased to such an extent that its downward pressure should exceed the downward pressure at the other end of the trough by the weight of one foot of water, that disturbance of equilibrium would remain permanent, since it would "be totally inadequate to overcome the mere molecular resistance of the water to go into motion." Now not only Mr. Hawksley, but every high Mathematical authority whom I have consulted, has assured me that the assertion that the "viscosity" of water would be adequate to prevent water whose equilibrium has been disturbed to the extent just mentioned, from ever recovering it, is *totally inadmissible*. However slow the motion might be, motion would most assuredly be induced; and however small its original rate, a momentum tending to its continuance must be generated from the instant of its

commencement; so that if the initiating force be in constant action, there will be a *progressive acceleration* of its rate, until the increase of resistance equalizes the tendency to further acceleration. Now if it be admitted that the propagation of the disturbance of equilibrium from one column to another is simply retarded, not prevented, by the "viscosity" of the liquid, I cannot see how the conclusion can be resisted, that the constantly maintained difference of Gravity between the Polar and Equatorial columns really acts as a *vis viva* in maintaining a Circulation between them.

138. Though at first characterizing the Polar underflow to the Equator, and its uprising there to the surface, as a "supposition highly improbable," Mr. Croll has now been led by the 'Challenger' observations to admit its existence; but still tenaciously holding to his preconceived theory that there can be no Ocean Circulation other than that which is produced by Wind, he gives the following as *his* explanation of what he calls the Polar under-current. The part of the Gulf-Stream which is propelled northwards by its original *vis à tergo*, entering the "closed" Arctic basin, must force out of it a quantity of water equal to that which is driven in; and this it is which finds its way along the bed of the North Atlantic towards the Equator; the initial force given by the Trade-winds to the Equatorial current thus serving not only to carry Equatorial water into the Arctic basin, but also to bring an equivalent amount of Polar water back to the Equator. This view appears to me open to the following obvious objections:—

a. Though Mr. Croll speaks of the Arctic basin as "closed," he seems to forget that it is not closed like a box, which can only hold a certain quantity of water, and into which no more can be forced in without forcing out an equal amount. Mr. Croll must know perfectly well that it is like a lake-basin (such as that of the Lake of Geneva) lying in the course of a river, from which all the water that flows in at one end (save what is lost by evaporation) flows out at the other, without raising its level, save when the inflow is in excess of what the outflow can carry away in the same time. And if a northward branch of the Gulf-Stream be really impelled by its initial force into the Arctic basin, the first effect of such inflow will be to feed an equivalent *surface-outflow*; and such an outflow is represented by the Greenland and Baffin's Bay currents, which bring down quite as much Polar water as the northward branch of the Gulf-Stream can be reasonably supposed to carry into the Arctic basin. No such inflow can produce the *deep* outflow of glacial water which Mr. Croll regards as its complement, without *sensibly raising the level* of the basin, as in the case of the Highland sea-loch

(§§ 3, 4), so as to do so by excess of superincumbent pressure; and since, to give a sensible motion to this outflow (according to the experiments on which Mr. Croll takes his stand), a force equal to 1 in height to 500,000 of length is required, a constant elevation of the level of the "closed" Arctic basin must be maintained, notwithstanding the surface-outflow just alluded to, of as much as 65 feet, to produce an underflow extending 6200 miles to the Equator. That such an elevation can be maintained by the residual force of a northern branch of the Gulf-Stream, of which the rate of movement, after it has been broken-up in the Mid-Atlantic, has come down, between Lat.  $60^{\circ}$  and  $65^{\circ}$ , to a "set" which appears to average less than three miles per day (§ 113), seems to me utterly incredible.

b. A comparison of the sectional area of the Gulf-Stream, as shown in Section III., with the sectional area of the Polar underflow across the whole breadth of the Atlantic, seems to me to show the utter inadequacy of the former to give motion to the latter. To this it is replied by Mr. Croll (who accords in this view with Professor Wyville Thomson), that the communication of heat from the subjacent crust of the earth to the cold water flowing over it, must be so slow that an almost *secular* movement of Polar water would be sufficient to maintain the glacial temperature of the seabed. But there are several considerations which lead to the belief that the movement of the glacial underflow is *not* of the extreme slowness required on this hypothesis. The surging-up of the cold stratum along the United States coast (§ 92), and its passage over the ridge in the Florida Channel (§ 148), could not take place unless it had a sensible movement. And—what is perhaps still more conclusive—the coldness of the Equatorial belt (§ 107) could not be sustained, unless there were a continual *upward* movement of the Polar stratum, necessitating, of course, a constant horizontal renewal of that stratum. And this accords with the indications presented by the well-known southern transport of icebergs across the line of the Gulf-Stream, and the similar transport of the buoy of the Atlantic Cable of 1865 (§ 104).

c. But a yet stronger objection to Mr. Croll's doctrine is afforded by the fact, which was predicted by myself as a necessary corollary of the doctrine I advocate, and has been clearly established by the 'Challenger' observations, that the glacial under-flow proceeding from the Antarctic basin is much more voluminous than that which proceeds from the Arctic. Now as the Antarctic basin is entirely open, and there is no Gulf-Stream to force water into it, how is this fact to be accounted for, unless the constantly-maintained disturbance

of thermal equilibrium is accepted as its *vera causa*? The explanation offered by Mr. Croll shall be given in his own words:— “When we consider the enormous amount of water which is “being constantly transferred from the South into the North “Atlantic—a quantity which to a large extent is compensated by cold “currents from the Antarctic regions—we readily understand how the “Polar water comes nearer to the surface in the former ocean than “in the latter” (‘Nature,’ May 21, 1874, p. 53).—I must confess myself entirely unable to apprehend Mr. Croll’s conception. His words seem to me to mean that there is (1) a continual transfer of Antarctic water, by a cold under-current, towards the Equator, and (2) a like continual transfer, by a warm surface-current, of South Atlantic water towards the Arctic Sea. But he does not tell us how the water thus continually moving from the South towards the North Pole *finds its way back again*; and without such an explanation his hypothesis is obviously inadmissible. Further, his idea—borrowed from Professor Wyville Thomson—that the Antarctic under-flow is drawn into the Intertropical area by the removal of its surface-water, has been already tried by a competent tribunal, and found wanting (§ 139).

139. Professor Wyville Thomson, who shares Mr. Croll’s incredulity as to the Thermal Circulation, regards the Polar under-flow as an *indraught* into the Equatorial area, to replace the surface-water which he represents as being continually swept off by the Equatorial current and transported northwards. Now it seemed to me that on the axiomatic principle of “least action,” a *surface-outflow* will always be replaced by a *surface-indraught*, wherever this can be supplied; and that as we have distinct evidence of such indraught or supply-currents, as feeders of the Atlantic Equatorial, in the North African and Guinea current on the northern side, and the South African on the other, the uprising of the whole mass of Equatorial water, so as to produce the bottom-indraught required to bring water all the way from the Poles, is physically improbable, if not impossible. In order to obtain an authoritative judgment on this question, I brought it before the Mathematical and Physical Section of the British Association at its meeting in Edinburgh (1871); and the verdict unanimously pronounced by the able Physicists who took part in the discussion, was against Professor Wyville Thomson’s hypothesis. I have been surprised, therefore, at seeing it reproduced in his last publication on the subject, as if it were physically adequate.

## APPENDIX III.—THERMAL WORK OF THE TRUE GULF-STREAM.

140. As part of the opposition of Professor Wyville Thomson and Mr. Croll to the doctrine of a General Oceanic Circulation depends on what I cannot but regard as a very exaggerated estimate of the Thermal work of the true Gulf-Stream or Florida Current, I think it desirable to append to this Paper a concise statement of the present state of our knowledge on the subject; derived mainly from the investigations of the United States' Coast Survey. And as Professor Wyville Thomson, in his discussion of the subject (' Depths of the Sea,' chap. viii.), has brought prominently forward a passage in one of my earlier Lectures (1870), in which I spoke of the Gulf-Stream movement as "a peculiar case of the General Oceanic Circulation, modified by local conditions," I think it desirable here to state *in limine*, that I had not at that time attained to the clear conception of the entire difference between the *horizontal* circulation produced by the action of Wind upon the surface, and the *vertical* circulation produced by disturbance of Equilibrium, to which I was led by the discussion which took place upon my first communication to the Royal Geographical Society. That distinction having been very plainly set forth in my published Paper (' Proceed. Roy. Geogr. Soc.,' Jan 9, 1871, p. 87), and in my Third Report to the Royal Society, I cannot but regret that my earlier rather than my more mature conclusions should have been made the basis of Professor Wyville Thomson's criticism.

141. Considering the two Circulations, as I now do, to be entirely distinct, and fully accepting the dependence of the Gulf-Stream movement upon the initial force communicated by the Trade-Winds to the Equatorial Current, I shall now follow this Current through its progress from its origin to its final decline.

142. The Equatorial Current is estimated by Captain Nares to have a depth of not much more than 50 fathoms, and an average rate of 0·75 mile per hour, at the surface, coming down to 0·4 mile at 50 fathoms. As his report does not contain details of its thermal condition, I avail myself of the temperature-observations taken in the New York School-Ship 'Mercury' in 1871 (kindly supplied to me by Professor Draper), which give means of comparison between the surface and sub-surface temperatures of the Equatorial Current, and those of what may be called the head water of the Florida Current within the Gulf of Mexico. The 'Mercury' crossed the Atlantic in the month of March from Sierra Leone to Barbadoes, running before a nearly steady E.N.E. Trade-wind, with an Atmospheric temperature ranging from 77° to 83°, the surface-temperature

of the Sea ranging from 75° to 80. At a depth of 100 fathoms, the temperature was 62°; while at 200 fathoms it was found to be everywhere (save in comparatively shallow water, § 74) between 51° and 53°, the mean of eight observations being exactly 52°. Having proceeded from Barbadoes to St. Thomas, the 'Mercury' sailed, during the first fortnight of April, along the southern side of Porto Rico, St. Domingo, and Cuba, finding deep water everywhere; and then, rounding the western extremity of Cuba, she made her way northwards through the Florida Channel. Now in this part of the course, the temperature of the Air ranged from 80° to 84°, and the surface-temperature of the Sea from 83° to 86°, showing a considerable elevation, which is probably attributable to the influence of continued insolation on the Equatorial Current. But a still more marked excess shows itself in the temperature of the stratum beneath; for at 100 fathoms the temperature was found to be 72°, and at 200 fathoms 62° (in both cases *ten degrees* above the temperatures at corresponding depths in the outside Atlantic), at 300 fathoms 54°, at 400 fathoms 50°, and at 500 fathoms 48°.—This seems to indicate that the partial separation of the Caribbean Sea from the basin of the Atlantic produces somewhat the same effect upon the temperature of its deeper water, that is shown in a much more remarkable degree in the Mediterranean (§ 35); for if the bottom inflow of Polar water be impeded (though not altogether prevented), the temperature of the whole mass of the water that is not directly subjected to solar influence will of course be proportionally higher.\* But it may well be that the force of the surface-current, when embayed in the landlocked basin, carries its heated stratum to a greater depth than it has when freely moving across the open Ocean.

143. As the Current nears its outlet, however, in the Florida Channel, we find very distinct evidence of an inflow of *cold* water from the outside; the source of which it will be well here to consider. Mention has already been made of the *Polar Current* that impinges against the Gulf-Stream on the Banks of Newfoundland; of which a southward extension can be very distinctly traced along the sea-board of the United States, as a distinct band of separation

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\* It is remarkable, however, that on the Mosquito Coast—where a very high surface-temperature usually prevails—the sub-surface temperature seems to correspond more closely to that of the outside Atlantic; the following observations being given by Capt. Maury from the journals of Mr. Dunsterville:—at 240 fathoms, 48°; at 386 fathoms, 43°; at 450 fathoms, 42°. This difference is perhaps attributable to the much freer and more direct communication which exists between the deeper parts of the *southern* portion of the Caribbean Sea and of the outside Atlantic, than that which its *northern* portion possesses.—Further inquiry into the sub-surface temperature of different parts of the Caribbean Sea and the Gulf of Mexico is much to be desired on various grounds.

between the coast line and the Gulf-Stream, as far south as Cape Hatteras; and this "cold band" can be traced southwards, though without perceptible movement, as far as the Florida Channel. For although its surface may be warmed by an overflow from the Gulf-Stream (as, in the 'Lightning' channel, the glacial stream from the N.E. is overlain by the warm stream from the S.W.), yet its presence is distinctly indicated by the rapid descent of the thermometer at small depths beneath. Thus off Sandy Hook, where the distance of the Gulf-Stream from the coast is about 240 miles, the temperature of the surface near the coast is  $70^{\circ}$  in summer, rises to  $75^{\circ}$  at about 150 miles' distance, and to  $83^{\circ}$  at about 275 miles, where the section crosses the warmest band or axis of the Gulf-Stream: but at a depth of only 20 fathoms in this intervening band, the thermometer falls to  $60^{\circ}$ ; at 100 fathoms it averages about  $47^{\circ}$ ; at 200 fathoms it is about  $43^{\circ}$ ; at 300 fathoms from  $39^{\circ}$  to  $42^{\circ}$ ; and at 400 fathoms from  $37^{\circ}$  to  $40^{\circ}$ . As soon, however, as the "cold wall" has been passed, the thermometer at 20 fathoms rises to  $77^{\circ}$ ; at 100 fathoms to  $67^{\circ}$ ; at 200 fathoms to  $62^{\circ}$ ; at 300 fathoms to  $59^{\circ}$ ; and at 400 fathoms to  $55^{\circ}$  or even  $58^{\circ}$ .—The breadth of this "cold band" whose continuity with the Polar under-flow beneath the Gulf-Stream has been distinctly proved by the 'Challenger' soundings (§ 92), gradually diminishes as we follow it southwards; but a continuity of low temperature is distinctly traceable along the whole length of the Floridan Peninsula, from Cape Canaveral, where its breadth is about 35 miles, into the Florida Channel itself. Here the Gulf-Stream is separated from the American shore-line by a band about 10 miles broad, in which the temperature falls within 100 fathoms to  $50^{\circ}$ , whilst in the axis of the Stream it averages  $75^{\circ}$  at that depth; and very distinct evidence of the *inward* movement of this colder band is afforded by the fact, first pointed out by Professor Agassiz\* and since verified by Capt. E. B. Hunt (of the U.S. Engineers), that the Florida Keys and Reefs are slowly but steadily extending *westwards*.† During rough weather, the sea about the reefs becomes milky from the stirring-up of the deposit at the bottom; and this "white water" is invariably drifted to the westward, the matter it carries being slowly deposited both north and south of the line of Keys, and 30 or 40 miles to the southward of them. That the inward counter-current, of which this fact affords evidence that may almost be called demonstrative, occupies not only that shallower portion of the channel which follows the coast-line of Florida, but the lower portion of the deepest part of each section, where it underlies the axis of the out-flowing Gulf-

\* 'U.S. Coast Survey Report,' 1851; and Appendix 10, p. 145, 1860.

† 'Silliman's American Journal,' vol. xxxv, pp. 197-210 and 388-396.

Stream, may be inferred with equal certainty from the Temperatures met with at different depths in each Section, from the surface downwards (§§ 144-8).

144. It is on the line of Section taken by the United States Coast Survey in 1866, between the Dry Tortugas and Havana, *within* the Florida Channel, that our detailed knowledge of the Gulf-Stream commences. The breadth of this channel is about 82 miles; and its maximum depth, which is met with at about 37 miles from the Cuban shore, is 845 fathoms. On the northern side, the bottom lies in terraces, which are nowhere abrupt; but on the southern side, about halfway between the deepest part and the Cuban shore, there is a steep ridge rising about 400 fathoms from the sea-bed, so as to come to within about 350 fathoms from the surface. The course of the bathymetrical Isotherms in the different parts of this Section is very remarkable. Instead of lying parallel to the surface, they follow the contour of the bottom; *the colder water being found much nearer to the surface in the shallower than in the deeper portion of the channel.* The following is the bathymetrical range of these lines at intervals of  $5^{\circ}$ :-

Temperature.								Range of Depth.
75°	..	..	..	..	..	..	..	20 to 130 fathoms.
70°	..	..	..	..	..	..	..	60 to 180 "
65°	..	..	..	..	..	..	..	75 to 250 "
60°	..	..	..	..	..	..	..	90 to 320 "
55°	..	..	..	..	..	..	..	150 to 380 "
50°	..	..	..	..	..	..	..	200 to 440 "
45°	..	..	..	..	..	..	..	350 to 500 "
40°	..	..	..	..	..	..	..	480 to 550 "
35°	..	..	..	..	..	..	..	580 to 600 "

Thus it appears that the lower half of this channel is occupied by water whose temperature is below  $50^{\circ}$ ; and that this colder water is thrown up in the shallower parts of it to within 200 fathoms of the surface. Looking to the steady diminution of temperature with depth, until a temperature of  $35^{\circ}$  is reached at about 600 fathoms, it can scarcely, I think, be questioned that the whole of the water below the bathymetrical Isotherm of  $50^{\circ}$  is an *inward* prolongation of the Polar underflow; the *outflowing* Gulf-Stream being limited to the stratum of  $60^{\circ}$  or upwards. This limitation was indicated also by the deflection of the Sounding-line occasioned by the current; which led the U.S. Surveyors to the conclusion that the outwardly moving stratum has not above *one-third* of the actual depth of the channel. In the northern half of this section, above the terraces south of the Florida Reefs, the water lies almost motionless; and the eastward flow of the Gulf-Stream is limited to the deeper southern half of the channel.

145. Proceeding about 120 miles to the eastward, we find that while the channel (between the Sombrero Lighthouse and the Salt Key Bank) is narrowed to 45 miles, and its maximum depth is reduced to 600 fathoms, the evidence of a division between two strata is still more distinctly marked by the course of the bathymetrical Isotherms. The northern slope, as in the previous instance, is the more gradual, the depth being only about 120 fathoms at a distance of 13 miles from the American shore; and here we find that while the temperature at 50 fathoms is  $75^{\circ}$ , so rapid a reduction shows itself with increase of depth, that the bottom at 120 fathoms is below  $50^{\circ}$ . In mid-channel, on the other hand, where the depth is the greatest, the line of  $50^{\circ}$  sinks to 175 fathoms, while towards the Salt Key Bank it is found at 200 fathoms: and the whole mass of water that occupies the deeper portion of the channel has a temperature below  $50^{\circ}$ , the thermometer showing  $45^{\circ}$  at 250 fathoms,  $40^{\circ}$  at 350, and  $35^{\circ}$  at less than 400.—Thus it seems clear that the colder water which underlies the warm Gulf-Stream surges up on the shallower bottom of the northern side of it, so as to rise to within 120 fathoms of the surface, though overlaid by a thin stratum of water having nearly the temperature of the Gulf-Stream proper.

146. After passing Sombrero Lighthouse, the channel of the Gulf-Stream begins to turn northwards; and the next line of section, taken between Carysfort Lighthouse and the Great Bahama Bank, shows it to have somewhat widened, and at the same time become shallower. The total breadth of the channel is here about 60 miles; but of this, a band of about 15 miles broad on the Florida side appears to be occupied by the Polar Stream. The maximum depth in mid-channel is about 500 fathoms; and the portion of it that exceeds 400 fathoms in depth is about 35 miles broad. The general character of this section very closely approximates to that of the Havana section, except that the slope of its banks is more equal. It is only on the American side, however, that the Isotherms down to  $50^{\circ}$  run upwards, showing the approach of the colder water to the surface. Thus the temperature of  $55^{\circ}$  is there found at 125 fathoms, whilst on the other side it is not reached at 250. At 350 fathoms in mid-channel, the temperature is below  $50^{\circ}$ , and in 60 fathoms more it is reduced to  $40^{\circ}$ . Although the temperature does not seem to have been observed at depths much greater than 400 fathoms, it can scarcely be doubted that it would be found as low as  $35^{\circ}$  in the deepest part of this channel, as it is at a less depth in the Sombrero section.

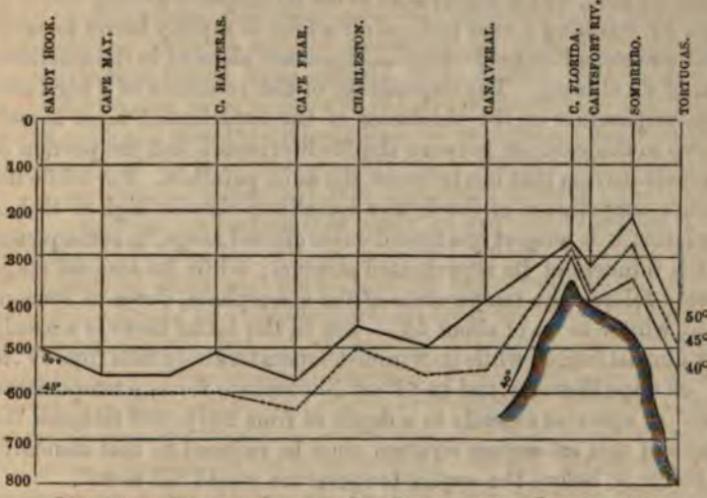
147. The channel again contracts and diminishes in depth, as far

as Cape Florida, between which and the Bemini Isles (the part known as 'The Narrows') its sectional area is smallest. While its whole breadth is not much more than 40 miles, the Polar stream occupies 15 miles of this breadth on the Florida side; and while its greatest depth scarcely exceeds 300 fathoms, even this excess only extends over a breadth of about ten miles, forming a valley on either side of a submarine ridge. The Florida slope shows a well-marked succession of terraces, whilst the Bemini slope is very steep. It is most singular to see how the bathymetrical Isotherms here follow the undulating contour of the bottom, instead of lying parallel to the surface; plainly indicating that the colder and heavier water has a motion of its own, by which it is carried up the slopes of the hills, instead of finding its level in the valleys. The 75° line, which lies at the surface on the Florida side, sinks to nearly 100 fathoms in the deepest part of the channel; and at ten miles from Cape Florida, where the whole depth but little exceeds 160 fathoms, the water has a temperature of 70° even at 75 fathoms, clearly showing the extension of the warm stratum to that side of the channel. But below 75 fathoms, on this terrace, the temperature falls so rapidly, that 45° is reached at 140 fathoms; though in the deeper channel the water at that depth has a temperature of 65°, sinking to 45° at 250 fathoms. No temperature below 45° is recorded as having been observed in this section; but if the rate of bathymetrical reduction between 200 and 250 fathoms be continued downwards to a bottom below 300, the temperature of the lowest stratum will be found as low as 35°.

148. Although the temperature of 35° was not actually observed either in the Carysfort or in the Bemini sections, the fact that it showed itself in the deepest water of both the Sombbrero and the Tortugas sections, and in the latter at a depth of less than 400 fathoms,—taken in connection with the difficulty, if not the impossibility, of otherwise accounting for the presence of water of 35° within the Narrows,—seems fully to justify the assumption that a glacial stream has flowed over what may be called the submarine watershed between Cape Florida and the Bemini Isles: and it is clear that in so doing it must have flowed up a very considerable ascent, which it could only do in virtue of a constantly acting propulsive force. This is strikingly shown in Diagram VII., which represents the longitudinal course of the bathymetrical Isotherms of 50°, 45°, 40°, along the axis of the Gulf-Stream in its passage through the Florida Channel.—The 'Challenger' soundings show that off Sandy Hook (No. IV.) a temperature of 40° is met with below the Gulf-Stream, at between 600 and 700 fathoms, coming up

to within 300 fathoms of the surface nearer the coast line; and that near Halifax (No. III.) water of  $35^{\circ}$  rises over a still shallower

DIAGRAM VII.



LONGITUDINAL SECTION IN COURSE OF GULF-STREAM, SHOWING BATHYMETRICAL ISOTHERMS.

bottom to no more than 83 fathoms from the surface. There is, therefore, no improbability in water of the same temperature finding its way through the Florida Channel into the Gulf of Mexico.

149. The most striking peculiarity in the Thermal condition of the Gulf-Stream, as compared with that of the Ocean through which it flows in the first part of its course, seems to consist, not so much in its more elevated surface-temperature, as in the greater thickness of its superheated stratum; which has a most important influence alike on the maintenance of its surface-temperature when it comes to be exposed to an atmosphere colder than itself, and also on its power of imparting heat to that atmosphere. It is obvious that the thinner the superheated stratum, the more speedily will its temperature be brought down by that of the colder air above it. But it is also clear that its loss of heat may be really much greater than the reduction of its surface-temperature would indicate; for as fast as its superficial stratum is cooled down, its increase of density will cause it to sink until it meets with water as cold as itself, the warmer sub-surface stratum rising into its place. And since this process will continue to take place so long as there is a subjacent stratum of higher temperature than the superincumbent atmosphere, the surface-temperature of the current may be maintained with com-

paratively little reduction, though the temperature of its subjacent strata may have been reduced almost to that of the ordinary Oceanic water which it overlies. But in the very same proportion that it thus *loses* heat, will it *impart* heat to the Atmosphere above; and may thus, by warming a vast body of air which is rapidly borne towards North-western Europe, furnish an important element in the amelioration of its climate. The dependence of the retention of a high surface-temperature on the thickness of the superheated layer is well shown in the contrast between the Mediterranean and the portion of the Gulf-Stream that lies between the same parallels. For while the surface-temperature of the former sometimes rises as high as that of the latter, it is subject to a considerable *diurnal* range, in consequence of the thinness of its superheated stratum; while its *seasonal* range closely follows the temperature of the atmosphere, down to its constant winter mean of about  $54^{\circ}$ . But in the latter there is scarcely any diurnal range; while its winter-temperature only falls from  $77^{\circ}$  to  $72^{\circ}$  off Cape Hatteras, and to  $67^{\circ}$  off Nantucket; for as a temperature of  $60^{\circ}$  or upwards extends to a depth of from 200 to 300 fathoms, the whole of this *sub-surface* stratum must be reduced to that standard, or below it, before the *surface-temperature* would fall to  $60^{\circ}$ .

150. The *thermal power* of the Gulf-Stream, or of any similar Current, must depend on three factors—(a) the *Sectional Area* of the Stream; (b) the *Rate* of its flow; and (c) its *Temperature*.

151. It is impossible, in the present state of our knowledge, to arrive at any exact estimate of the *sectional area* of the Stream; since it is for the most part only from the Temperatures of its different strata that we can judge whether they are, or are not, in movement, and what is the direction of their movement. If we accept the conclusion of the U.S. Surveyors (§ 144) that in the *Havana* Section the depth of the *outward* current was not above one-third of the depth of the Channel,—averaging, therefore, about 200 fathoms,—and taking the average temperature at that depth to be about  $60^{\circ}$ , we may assume that the stratum extending downwards to  $60^{\circ}$  in other sections represents the real outwardly flowing Stream. Now in the Cape Florida and Bemini Section, the line of  $60^{\circ}$  in the channel of the Gulf-Stream proper has an average depth of about 175 fathoms, or 1050 feet; but the breadth of the outflowing Stream cannot be taken (according to Professor Bache's estimate) at more than 25 miles.—Mr. Croll's estimate of the quantity of water as equal to a stream 50 miles broad and 1000 feet deep, appears to be based on the sectional area of the entire channel, which he states at 30 miles broad and 1950 feet deep; but it seems clear that the lower portion of this channel must

be occupied by an *in-flowing* current; and the only question is with respect to the depth at which the reversal of the flow takes place, as to which there is room for difference of opinion.

152. The *mean annual rate* of the Gulf-Stream current, however, can now be positively affirmed,—on the basis of a large number of observations taken at various periods of the year, and correlated by our Meteorological Department,—to be far less than is usually supposed; being, even in the “Narrows,” where the current is most rapid, not more than *two miles* per hour, or 48 miles per day.\* During six months of the year, the monthly mean is *below* this rate, averaging only 34 nautical miles per day; during the other six months it is *above* this rate, averaging 60·6 miles per day, or 2½ miles per hour. The *lowest* monthly mean (August) is 30 miles per day; the *highest* (July) is 73·6 miles per day.†—But the rate given by *surface-observation* affords no indication whatever of the rate of movement in the sub-surface stratum, as has been already shown (§ 142) in the case of the Equatorial Current; and our knowledge of double currents would lead to the belief that it gradually diminishes from above downwards, until the water becomes motionless, or nearly so, as we approach the plane of reversal. Hence, taking the mean between *two miles* and *zero* as the only guide we have, the *average rate* of the whole outflowing stream would be no more than *one mile per hour*.

153. If we assume the limit of the stratum above 60° as that of the real Gulf-Stream current, we shall find its *average temperature* to be somewhat higher than it has been stated by Mr. Croll, who seems to have taken 65° as the average of the water flowing through the *entire* channel. The *average surface-temperature* of the Florida Channel for the whole year is 80°; and we may set the average of the entire outgoing Stream, down to the plane of 60°, at 70°, instead of 65° as estimated by Mr. Croll.

154. The prevalent doctrine, however, of the persistence of this temperature, with but very trifling reduction, nearly as far as the Banks of Newfoundland, is based on observations made during the Summer; when the Isotherm of 70° extends north of the parallel of

\* ‘Currents and Surface Temperature of the North Atlantic,’ 1872, p. 23.

† I reproduce these figures with confidence, as presenting the nearest approach to the true state of the case, notwithstanding Mr. Croll’s assertion that they are altogether erroneous (‘Philosophical Magazine,’ March 1874, p. 176). Finding in the Admiralty chart the *minimum* rate to be 32 miles per day, and the *maximum* to be 120, Mr. Croll affirms the *average* rate to be the *arithmetical mean* between these two extremes; namely, 76 nautical or 87 statute miles per day, or fully 3½ miles per hour: that is to say, he makes the annual mean to be *more than double* the monthly average for six months of the year, and even *greater than the highest average* of any one of the other six months!

40° N., and the cooling influence of the atmosphere is consequently at its least. In Winter, on the other hand, when the Isotherm of 60° follows nearly the same line, the surface-temperature of the Gulf-Stream is reduced almost to that degree before it reaches the Banks; as is shown in the following Table, derived from the Admiralty Chart:—

	Winter.	Spring.	Summer.	Autumn.	Mean of Year.
Gulf of Mexico .. .. ..	73	77	83	80	79 $\frac{1}{4}$
Florida Channel .. ..	77	78	83	82	80
Off Charleston .. .. ..	75	77	82	81	79 $\frac{1}{4}$
Off Cape Hatteras .. .. ..	72	73	80	76	75 $\frac{1}{4}$
S.E. of Nantucket Shoals	67	68	80	72	71 $\frac{1}{4}$
South of Nova Scotia ..	62	67	78	69	69

Thus it appears that, instead of a loss of only 5° in the northward flow of the Gulf-Stream from Lat. 25° to Lat. 35°, the average loss for the whole year is 11°. And the cooling influence of the superincumbent Air on the Gulf-Stream, even at its deepest and strongest, is manifested in its loss of 13° of surface-temperature in the Autumn, and of 15° in the Winter, although its passage thus far is accomplished in from forty to fifty days. During this time, it must be remembered, it continues to lose heat by evaporation as well as by radiation; the large amount of vapour which is being continually given off, being made manifest by its precipitation in the form of fog, when the Gulf-Stream encounters the Arctic current which meets it before it reaches Newfoundland.

155. It is, again, on the contrast in Temperature between the Gulf-Stream and the Arctic current,—not between the Gulf-Stream and the ordinary water of the Atlantic,—that the prevalent notions respecting its special heating-power are mainly founded. Thus Admiral Sir Alexander Milne, proceeding in H.M.S. 'Nile' from Halifax to Bermuda in May 1861, found the temperature 70° at the bow, when it was only 40° at the stern; thus showing a difference of 30° within the ship's length.—When, on the other hand, the temperature of the *eastern* edge of the Gulf-Stream in the earlier part of its course, and of the *southern* edge in the later part of its course, is compared with the normal of the neighbouring portion of the Atlantic, the difference is found to be comparatively slight, the one graduating into the other.

156. The average rate of two miles per hour, which the Gulf-Stream has in the Narrows, is maintained to Lat. 30° N.; but it then begins to show a decided reduction, falling to 40 miles per day

between  $30^{\circ}$  and  $33^{\circ}$  N. When the Stream passes Cape Hatteras, and its land side is pressed on by the Arctic current, this compression seems to have the same effect in increasing its velocity that limitation between banks would exert; for the rate of flow there rises again, sometimes exceeding, *four miles* per hour. Captain Nares estimates the breadth of the Stream at that point at 60 miles, its depth at 100 fathoms, and its rate of flow at three miles an hour. But this obviously refers to its *inner* edge, since the American Surveyors distinctly state that the rate of the Stream at its *outer* edge is not greater than from 10 to 20 miles per day.—The direction of the Stream is gradually changed by the trend of the coast-line, first from N. to N.E. by N., then to N.E., and subsequently, after being subject to the influence of the Arctic current, to E.N.E. Part of this Easterly deflection, however, is probably to be attributed to the greater easterly momentum which this body of water brings with it from its southern source, in virtue of its excess of rotary velocity; as was first pointed out by Captain Maury, whose view on this point was adopted by Sir John Herschel.

157. Very early in its course, the Gulf-Stream begins to show a division into alternate bands of warmer and colder water; and these become very perceptible before it passes Charleston. The cause of this division appears to lie in the contour of the bottom in the Florida Channel; the elevations of which, as already stated (§ 147), throw up the colder water of the deeper stratum nearer to the surface. With the increase in the breadth of the Stream as a whole, there is at the same time an increase in the distance between the bands. Thus at Cape Hatteras, where the "cold wall" separating the Gulf-Stream from the Arctic Current is 30 miles from shore, the first or axial band of the Gulf-Stream has a breadth of 47 miles; to the east of this there is a cold band 25 miles broad; and this is succeeded by another warm band of 45 miles. These two warm bands, with the intervening colder band, are considered by Professor Bache as constituting the *Gulf-Stream proper*; but to the east of this, beyond another cold band of 37 miles' breadth, there is still another warm band 75 miles broad. Off Sandy Hook, where the Stream makes its great bend to the East, and the "cold wall" is at a distance of 240 miles from the shore, the "Gulf-Stream proper" has only increased in breadth from 117 miles to 127; but the breadth of the second cold band has now increased from 37 miles to 60, whilst the breadth of the third warm band has diminished from 75 miles to 50; the outer portion of the Stream showing an obvious tendency to lose itself in the general mass of Oceanic water. The *total* breadth of the Gulf-Stream is stated

by the American Surveyors to be 350 miles off Cape Hatteras, and 410 miles off Nantucket; but as the outer boundary is not well defined, these estimates are only approximative.

158. The difference in the rate of movement of these bands is probably one source of the discrepancy in the statements given by different authorities, as to the rate of the flow of the Gulf-Stream as a whole. It is commonly said to pass Nantucket at the rate of about *one* mile an hour; and an observation cited in Blunt's 'Coast Pilot' would give about 0.7 mile per hour as its rate between W. Long.  $57^{\circ}$  and  $55\frac{1}{2}^{\circ}$ , between the 41st and 42nd parallels of Latitude. Many degrees to the east of this, however, a very rapid current—running at the rate of even *four* miles an hour—has been occasionally observed; and this is probably due, like that sometimes seen off Cape Hatteras, to the lateral pressure exerted by the Arctic current, which comes down in full force over the Banks of Newfoundland, sometimes extending far to the southward, directly into the course of the Gulf-Stream. It is during the early months of the year, that, under the influence of the N. and N.W. winds which then prevail along the coast of Labrador, the Arctic current—bringing with it immense fields of Polar ice—is at its strongest; and the Admiralty Chart shows the southward extension of this field-ice, between March and July, reaching even to the 42nd parallel between the meridians of  $55^{\circ}$  and  $45^{\circ}$  w. long.; while between April and June, icebergs range as far South as  $39^{\circ}$  between the meridians of  $50^{\circ}$  and  $40^{\circ}$ . This enormous body of Polar ice-laden water must have a powerful influence both on the movement and on the temperature of the Stream against which it impinges, more especially since the deep-floating icebergs will bring this influence to bear directly on its deeper strata; and it is considered by Mr. Findlay that "by the time the Gulf-Stream has reached this limit, " its original character is so thinned out and expanded, and its "specific character is so destroyed from this cause, and from the "neutralizing effects of the Labrador currents, that it can no longer "be recognized beyond this cold-water gulf, which cuts off, as it "were, its further progress, and which, it is manifest, it can neither "bridge over nor pass under" ('Proc. Roy. Geogr. Soc.', Feb. 8, 1869, p. 107).

159. That the Stream has here for the most part thinned-out to a comparatively shallow stratum running over much colder water, is indicated by the observations of Capt. Chimmo (*Op. cit.* p. 92 *et seq.*), which were made in July 1868, on the axis or northern border of the Gulf-Stream. Thus near the southern edge of the Grand Bank, the temperature of the surface being  $65^{\circ}$ , it was found to be

only  $50^{\circ}$  at 100 fathoms; and a large iceberg was met with as far as 30 miles south of the Grand Bank, showing the southward extension of an *underflow* of Arctic water, although the surface-temperature of  $62^{\circ}$  indicated that the upper stratum consisted of Gulf-Stream water flowing in a very different direction. "Although it was still "150 feet high, and nearly 400 immersed, it was quickly and per- "ceptibly undermining, decomposing, splitting with loud reports "and floating away in large portions with the easterly current." In another instance, the surface-temperature being  $61^{\circ}$ , the temperature at only 50 fathoms' depth was as low as  $43^{\circ}$ ; but there was here probably a mere overflow of the surface-stratum, corresponding to that which extends beyond the "cold wall" off the coast of the United States (§ 92). That there is still a warm band extending to a considerable depth, seems to be indicated by the sounding taken in Lat.  $43^{\circ} 30'$  n. and Long.  $38^{\circ} 50'$  w., to test the existence of the supposed "Milne Bank." Here the surface-temperature being  $73^{\circ}$ , the temperature at 100 fathoms was  $62^{\circ}$ , and at 300 fathoms was  $55^{\circ}$ ; and thus, although the temperature of the upper stratum was nearly ten degrees lower than that which it showed off Sandy Hook, the temperatures at 100 and 300 fathoms were nearly identical with those there found at corresponding depths, and were above those found at the same depths and under almost the same parallel nearer the coast of Europe; thus showing that the excess already noticed in the sub-surface temperature of the Western side of the Atlantic (§ 98) extends as far north as Lat.  $43\frac{1}{2}$ .

160. The direction of the Gulf-Stream current is here so nearly due East, that we should naturally look for its continuation across the open Ocean in the same direction. After passing the meridian of  $40^{\circ}$  w., however, we find the summer Isotherm of  $75^{\circ}$ , which rises between the meridians of  $45^{\circ}$  and  $65^{\circ}$  w. to the north of the parallel of  $40^{\circ}$  n., and the summer Isotherm of  $70^{\circ}$ , which rises to  $43^{\circ}$  n., as well as the winter Isotherm of  $60^{\circ}$ , which nearly coincides with it, all tending *southwards*,—the first very abruptly, the second and third more gradually (see Chart); and this tendency corresponds with the general set of the surface-current. From the coincidence of these facts, there can be no reasonable doubt that a very large portion of the Gulf-Stream here takes a *southward* direction, passing first S.E. towards the Azores, and then due S. and S.W., so as to return off Cape Verde into the Equatorial Current,—thus completing, with the North-African Current (§ 139), the "shorter circulation" of the North Atlantic. This concurs also with the results of the 'Challenger' observations (§ 93). The southward deflection of the Gulf-Stream current seems dependent on an *indraught*,

producing a supply-current for the replacement of the water driven westward by the Trade-winds (§ 139).

161. The question we have lastly to consider is,—What evidence can be adduced of the extension of any part of the Gulf-Stream *proper*, on the easterly line of direction which it retains on the Meridian of  $40^{\circ}$  w., to the western coast of Europe? I can find no other than that variable current known as “Rennells;” which, flowing eastwards into the southern part of the Bay of Biscay, is then deflected in a north-westerly direction by the turn of its coastline, so as to cross the Channel towards the Scilly Islands, thence passing to the S.W. coast of Ireland. The strength of this current mainly depends on the continued prevalence of the westerly Anti-trades; and it concurs with that general easterly “set,” which is perceptible over the whole surface of the Atlantic between the parallels of  $43^{\circ}$  and  $55^{\circ}$  N., beginning from the very edge of the Arctic current, and there extending as far as  $10^{\circ}$  to the north of the true Gulf-Stream, of which it is obviously quite independent.—We may also probably regard as eastward extensions of the Gulf-Stream, carried further than usual by prevalent winds, those bands of warm water which are occasionally met with in the Bay of Biscay; and it seems not improbable that the carrying northwards of similar bands by the general Polar indraught, is the cause of the peculiar local elevations which are to be met with between Shetland and Iceland (§ 114). But neither the course of the Atlantic Isotherms, nor the comparison of temperatures between the Atlantic seaboard of South-western Europe and the shores of the Mediterranean under the same latitudes, gives the least reason for believing that the winter temperature of Spain, Portugal, or France, is raised in any appreciable degree by the flow of water from a southern source; it being only when we pass the British Channel, that the northward trend of the Isotherms indicates such an amelioration, which is the more pronounced the further north we follow it. The Winter isotherms of  $55^{\circ}$  and  $50^{\circ}$ , indeed, tend southwards as they approach our shores; thus showing that any excess of *surface-warmth* which may be brought by a north-east flowing stream is lost before it reaches them. The continuance of the *northward* course of the Winter isotherms of  $45\frac{1}{2}^{\circ}$  and  $41^{\circ}$ , on the other hand, shows how much more effectual is the heating power of that *sub-surface* stratum, extending downwards to at least 600 fathoms (§ 121), of whose slow northward movement a *vera causa* has been shown to exist in the constantly renewed disturbance of Thermal Equilibrium between the Polar and Equatorial portions of the Oceanic area. To assert that this is nothing else than an extension of the *true* Gulf-Stream

or Florida Current, is simply (as it appears to me) to ignore all the evidence of the complete disintegration of that current, and the loss of every one of its distinctive attributes, in the mid-Atlantic, which has been furnished by Hydrographic inquiry.

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*Fourteenth Meeting, 15th June, 1874.*

MAJOR-GENERAL SIR H. C. RAWLINSON, K.C.B., VICE-PRESIDENT, in the Chair.

PRESENTATIONS.—*J. O. Chadwick, Esq.; Major E. Harding Steward, R.E.*

ELECTIONS.—*Major-General Bentinck; Algernon Brent, Esq.; Samuel Bailey Coxon, Esq.; Lieut.-Colonel J. G. R. Forlong (Madras Staff Corps); Robert Gordon, Esq., C.E.; George Grantham, Esq.; H. J. Jenkinson, Esq.; Robert Murray Lawes, Esq.; Rev. Richard Lewis, M.A.; The Marquis of Lorne; Archibald Robinson, Esq.; Robert B. Smith, Esq.; Le Vicomte Ernest de S. St. Jean; John Manners Sutton, Esq.*

PRINCIPAL ACCESSIONS TO THE LIBRARY SINCE 2ND JUNE, 1874.—‘Madagascar and Its People.’ By J. Sibree, Jun. ‘The Desert of the Exodus.’ By E. H. Palmer. ‘Robinson Crusoe, with Nautical and Geographical Notes.’ ‘Viage Pintoresco por los Ríos Paraná, Paraguay, Sn. Lorenzo, Cuyabá, y el Arino, con la Descripción de la Provincia de Mato Grosso.’ By B. Bossi. Presented by the author. ‘Facsimile of the Hereford “Mappa Mundi” by Havergal and Haddon, with accompanying Essay on Mediæval Geography.’ By W. L. Bevan and H. W. Phillott. ‘African Memoranda: Island of Bulama.’ By Capt. P. Beaver. ‘Annuaire de la Société des Études Japonaises.’ Album containing 43 photographic views of Madrid, Alexandria, and Cairo, and two albums containing 106 photographic views of Constantinople and its environs. Presented by C. H. Wallroth, Esq. ‘Persia, Ancient and Modern.’ By J. Piggot. Presented by the author. ‘En Sommer i Island.’ By C. W. Pajkull. ‘The Structure and Distribution of Coral Reefs’ (2nd edition). By Charles Darwin. Presented by the author. ‘The India Directory,’ Part I. By Captain A. D. Taylor. Presented by the author, through Messrs. Allen and Co.

ACCESSIONS TO THE MAP-ROOM SINCE THE LAST MEETING OF JUNE 1ST, 1874.—13 sheets of an especial Map of Hungary. 26 sheets of a Map of Central Europe. By Sheda, accompanied by three books.

398 sheets of the Ordnance Survey, and 80 area books. Presented through the Director of Survey, Sir H. James, R.E.

The CHAIRMAN said that he had been requested to take the Chair this evening, in the absence of the President, who had been obliged to go to Cambridge in order to receive an honorary Degree. He was the more pleased on this occasion to take the Chair, as the subject to be brought before the meeting referred to the geography of Central Asia, in which he had always taken the greatest interest, and to which he had devoted many years of study. But, before proceeding to the actual business of the evening, he thought it only due to the Society that he should notify to them the arrangements that had been sanctioned by Her Majesty's Government with regard to the late Dr. Livingstone and his family. He believed Sir Bartle Frere had informed them on a previous occasion that, in addition to the pension on the Civil List of 200*l.* a year, which had been bestowed upon the Livingstone family, an application had been made to Government for a further fixed capital sum for the family. He believed the sum which was recommended by the deputation that waited on the First Lord of the Treasury was 10,000*l.* or 11,000*l.*; but the Government, after due consideration, had thought that all claims would be liberally met by a grant of 3000*l.* Besides that, the Government had undertaken to pay all the arrears of pay which were due to Dr. Livingstone's followers and servants. On their arriving at the coast it was found that a sum of nearly 1000*l.* was due on this head, and the Acting Consul-General at Zanzibar had drawn for that amount upon the Geographical Society. The Society naturally felt that, although they took the greatest interest in Dr. Livingstone's proceedings, they were not properly responsible for these expenses; and when Sir Bartle Frere represented this to the Government they had, in a very fair and liberal spirit, consented to take the whole expense upon themselves. It would be understood, therefore, that all the pecuniary questions relating to Dr. Livingstone's late Expedition were now concluded.

The Chairman then introduced to the meeting Mr. SCHUYLER, the Secretary of the United States Legation at St. Petersburg, and a very distinguished traveller, who had recently returned from a most interesting journey in Central Asia. He was one of the very few Europeans—in fact, with the exception of the late Arthur Conolly and some Russian officers, he believed the only European—who had travelled in the interior of Kokand to the eastward of the present Russian possessions at Tashkend. Mr. Schuyler would now give them a brief account of his travels.

#### 1. *A Month's Journey in Kokand in 1873.* By EUGENE SCHUYLER, Esq.

Mr. SCHUYLER spoke as follows:—

"I had the good fortune last summer to spend about eight months in Central Asia. I started from St. Petersburg in the month of March, and went by way of Orenburg and the Sir Daria to Tashkend, which I made my head-quarters during a greater part of the summer. From there I went to Samarkand, and spent a month at Bokhara. I also spent a month, consisting of halves of June and July of last year, in Kokand. I returned by way of Isik-kul, the former Chinese province of Kulja, and through Southern Siberia. I left Khojent, the largest Russian town on the frontier, on the 19th June, in company with a Russian Engineer, who was going

to Kokand to buy timber to construct a bridge over the Sir Daria at Khojent. We passed one night at Kostakos, and next day arrived at Makhram, a frontier town with a large square fortress, containing a garrison of 500 Kokand troops. The town itself is nothing, and of no importance. From Makhram I went to the town Kanibatam, celebrated even in the times of Baber for its almonds, and from there through Bish-Aryk to the city of Kokand, the capital of the country. Just before reaching Bish-Ayrk, I had to pass through a stony plain of about ten miles wide. This plain surrounds Kokand on all sides, except on those nearest the mountain. There is no water there at all. There was not a sign of verdure, and the wells were all dried up. The only water which the people had was brought from the streams on the other side of this desert place. I was detained at Kokand for, I think, four or five days, while information was sent to the Khan, who had gone to Namangan, of my arrival, with a request that I might be allowed to proceed to him, and continue my journey. I had brought a letter of introduction from the Acting Russian Governor-General at Tashkend, who was filling the place of General Kaufmann. While at Kokand I had the opportunity of observing the city and the inhabitants to a certain extent, and to notice somewhat about the trade: but I cannot say that my sojourn there was eminently pleasant; for, although during the day I was allowed freedom of action, and could go where I pleased, yet it was intensely hot, and I was insulted and reviled by any native who chose to do so, as the Russians—and I was supposed to be one—were not held in good repute. Although I was nominally a guest of the Khan, they did not choose to offer me a lodging, and I was staying with some Russian merchants in a serai, but I was shut up from seven in the evening until five in the morning, just when it was cool enough to go out. Finally, the Khan sent permission for me to go farther, and I went to the north-east, to the town of Balikchi. I arrived there in the evening, and was placed in the court of a small house, where I was very uncomfortable; but I was told that nothing better could be done for me until we had been presented to the Khan on the following morning. We had to get up about five, mount our horses, and ride about half a mile along the shore of the river, until we came to the garden, where he was residing in some tents. This was an annual tour which the Khan makes through the country, not exactly for the purpose of collecting tribute, but to receive rich presents from the Bekhs, who really govern the country, subject to him. After a short time we came to two lines of soldiers dressed in the most singular costumes,

some with uniforms, some without; some with matchlocks, some with muskets, some with sticks, some with sabres, all seated cross-legged at the side of the road, holding their arms at 'present,' in honour of the distinguished company. We then had to walk on foot between these soldiers, until we were finally seized by the elbows by a number of officials,—who, I found, were generals,—wearing long black gowns, and three epaulettes each, one on each shoulder, and one in the middle of the back. They pushed us forward until we got in front of the garden, where, at a distance of 500 feet, under a small green tent, we saw a number of people seated. It was so far off that I was not able to distinguish the Khan, or to tell how he looked. We were told to make a deep bow, which we did, and to deliver our letters. As soon as we did this, we were taken by the arms and dragged back again. I was astonished at this, as, knowing something of the customs of the country, I thought it was preliminary to being presented to him. Two or three of the party, especially the natives, were under the impression that we were going immediately to have our heads cut off; but, as it turned out, we had nothing to fear on that score. We were then taken to the house of the Bek of Balikchi, who told us he was ordered by the Khan to receive us. He gave us his house and a large garden, where we were kept for three or four days, and we were allowed to go out. The only time that I and my interpreter availed ourselves of the opportunity to look at the large wooden bridge that crosses the river, we were treated with great politeness; but, when we came back, astonishment was expressed that we dared to go out alone. After that, even when we went to bathe, we had ten soldiers to guard us: I suppose, either to prevent our attacking the natives, or the natives attacking us. For a long time it seemed to be quite undecided what we should do. I was told that I would receive a passport, in the form of a letter, with which I could travel anywhere I chose. It was requested that, after I had finished my travels, I should come back to the Khan, wherever he might be, and thank him, and have the honour of a personal interview with him. As soon as I received the passport to go further, no more sheep were given to us, and it was necessary to get away as soon as possible, in order not to starve. I went to the south-east, through the land which lies between the Sir Daria and the Naryn, which is the most fertile part of the whole country, passing a small range of hills to the right, until I reached a little town near the Sir Daria, where I spent the night. We subsequently forded the Sir Daria in very large carts, and the next morning reached the town of Andijan, the second city of the

Khanate, having a population of about 40,000 or 50,000. It is tolerably well built, with a good bazaar, and a large number of serais and mosques, and has plenty of water through it. The Bek of the place is Muradin Bek, the eldest son of the Khan. He is rather more civilised than most of the others, because, some two years ago, he spent six weeks in Tashkend as a guest of the Russians, and has considerable sympathy with them. He is, in consequence, very much disliked by his father, who is very jealous of him, and afraid he is in some conspiracy to deprive him of his throne. He received me rather better, and permitted me to shake hands with him, and stand on the outside of the window, while he sat inside, and held some conversation with me. He even said two or three words in Russian. He presented me with a gown, as is the custom.

"After two or three days I went still to the south-east, about 40 miles, to the town of Ush, which was the extreme eastern limit of my journey. I was desirous of going to the east through the mountain-passes as far as Kashgar, which was only five days distant, but I was told that it would be utterly impossible to travel over the ground, that a rebellion of Khirgiz had broken out in the mountains, and, as they greatly valued my life, they would not dare to let me go. After considerable negociation, they finally told me that if I would sign a paper that, in case I was killed, the Russian Government would make no representation on the subject, they would let me go. I knew that that meant that they would kill me themselves, and naturally refused to sign the paper. I then wished to go south, thinking I might possibly go across the Alai range, and into the independent country of Karategin. No European has been to Karategin, and it was a country which excited a good deal of curiosity on my part. I had seen a great many of the inhabitants in Kokand, where a considerable number are employed in the custom-house,—thickset, stalwart men, speaking a dialect of Persian. Nearly all the people in the mountain-ranges south of Khojent, and even to the east of Tashkend, speak dialects of Persian, being evidently remnants of the ancient population, which have been driven further and further up into the mountains. I had heard from a Russian refugee in Kokand, that on the road to Karategin, in one of the passes, there were a number of inscriptions in a European language, and that excited my curiosity. This man read and wrote both Russian and the Toorki language, and insisted that the inscriptions were in a European language, and he had the idea that it was a souvenir left by some traveller who had passed over the route. If this is true, it would

be quite worthy the attention of any future traveller in that region. There are no remains in Ush which could possibly be said to be older than 150 years, and any story about Greek sculptures or Greek temples is certainly a myth. I finally obtained permission to go to Naugot, thinking that if I once reached the mountains I should get along perfectly well. I had not the slightest fear of the Khirgiz, for I know it is much easier to deal with them than with the more settled inhabitants. The Sirkar gave me a native mountain servant to go with me, and I had my interpreter and one servant beside. When I got to Orován—a place not marked in the map—I found I was on the road which led directly to Margilan, and it was almost impossible to get from there to Naugot. I was very indignant at this, and the man confessed he had deceived me, but had done so by superior order, because my life was too valuable to be risked. I was therefore obliged to go directly to Margilan. On the road I met large bodies of troops which were being sent against the insurrectionists. The Bek of Margilan had left that place and gone to meet the Khan, so that I remained only one day at Margilan; a very pretty town, flat, with a good many gardens and trees, and a large number of mosques in a much more decorative style of architecture than is usual. From there I went to a small village on the edge of the waste, to which all the water has to be brought from Margilan; and thence passed through the stony waste till I reached Kokand.

The city of Kokand is comparatively modern, having been built within the last 100 years. It is nearly square, and contains, they told me, about 500 mosques, each one having 30 houses: this, giving five inhabitants—a very small number—to each house, would make the population about 75,000, which I should think was about correct. It is very full of gardens; but, owing to its being entirely flat, it does not present the same picturesque aspect that the town of Tashkend does, though the streets are wider, and the houses in general much better built. There are several large mosques; some holding from 300 to 400 mollahs, but architecturally of very slight importance. One of the new ones is faced with white tiles, and is rather pretty. The finest building is the fortress, which is really the palace of the Khan. It was built in 1852. It has turrets at the corners, and a large entrance in the middle. It is beautifully faced with arabesque green tiles, with large inscriptions from the Koran running round the cornice. I was not admitted to the palace, as several of the wives of the Khan were still there; but the Atalik, or first military officer of the country, showed me through the armoury and the mint. In this latter place they were not

coining money, but making silver ornaments for horse-trappings, as the Master of the Mint exercises at the same time the functions of Court Jeweller. One of the most amusing things in the armoury was the making a breech-loading cannon. There was a 12-pounder piece well under way, and the breech-loading apparatus seemed an improvement on a Russian design, but the cannon was not rifled, and the balls were round. At the muzzle, too, the cannon was rather larger than at the breech. At the same time I was shown four rifles. It seems that two had been stolen from Russian soldiers, and the whole productive force of the country had for two months been making copies. The rifles worked pretty well, but I could not imagine how they were going to make cartridges for them. They were also making some rockets, which really were very good. The bazaar at Kokand is by far the best built one that I saw in Central Asia. The streets all cross at right angles. There are many shops, built of burnt bricks, and the whole is covered by a roof.

"It is possible to walk over the whole bazaar, from one end to the other; and all the avenues leading to it are closed every night, and guarded by soldiers stationed there. I had occasion to see these men, who were stationed also at my own gates; and I found them very amusing, not only as to their uniform, but as to equipment. I could not help noticing that at least two words of command were English. One was 'Carry arms' and the other 'Orja arms,' which I suppose to be 'order' arms, as they brought their muskets down to the ground. A great many of these men were armed with wands or sticks, which made me think that possibly that might be an English innovation. The bazaar is the personal property of the Khan. Some years ago he took possession of all the bazaars, either paying small sums for them or else taking them without payment, saying that the former proprietors had enjoyed them a sufficient time, and now it was his turn. The revenues are considerable. If the Russians should take possession of Kokand, this no doubt would be of considerable advantage to the Treasury. In all the towns they now have the bazaars are owned by private persons, or belong to some mosque or school. The chief trade with Kokand is in cotton and silk. The total trade of Russia with Central Asia in 1867 was £2,500,000. In 1872 it was set down at £3,000,000, but as over £1,000,000 must be deducted from that sum for the trade of the Khirgiz on the steppes, the total trade would be only £1,600,000, which would show a falling off. The imports to Kokand in 1872 were £300,000, and the exports a little less than £200,000."

The CHAIRMAN said he was sure the meeting felt much obliged to Mr. Schuyler, who had told them a great deal about a country of which very little was known before. He hoped that he would publish an account of his journey, which would be of very general interest both in this country and in America.

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2. *Extracts of Letters from Members of Mr. Forsyth's Mission to Kashgar relating to the Geographical Results of the Mission.* With Remarks by Major-General Sir H. C. RAWLINSON, K.C.B., &c.

I PROPOSE to bring before the Meeting some of the Geographical results of Mr. Forsyth's Mission to the Ameer of Kashgar. So much has been written of late years on the subject of the country which used to be called Western China, but which is now better known as Eastern Turkestan, that I may presume you to be acquainted with its general features and history. You know, for instance, that it occupies the great interior basin of Central Asia, intermediate between Russia and British India, being bounded on the north by the Thian-Shan, or Celestial Mountains, and on the south by the Kuen Luen, or mountains of Little Thibet. The skirts of this basin bearing an alluvial deposit, and being watered by streams from the circumjacent mountains, are well cultivated and densely peopled; but the interior is a desert throughout, composed, for the most part, of a sandy waste, with forests of jungle along the river-beds. The people, who are descendants of the ancient Ouigours, are a fine, frank, hardy race; Mahomedans, but not bigoted, very friendly indeed to Europeans, and superior, according to the experience of our officers, to all other Asiatics with whom they had come in contact. Indeed, the pictures given by Mr. Forsyth and his officers of the hospitable and unassuming manners of the people of Yarkand and Kashgar, their industry, intelligence, probity, and activity both of mind and body, impress one most favourably after the accounts one generally has of the sloth, and dirt, and misery, and depravity of the East. This country maintained its independence from the time of Timour to the latter half of the last century, when it was overrun by the Chinese, in whose hands it remained, with some rare intervals of partial insurrection, until eleven or twelve years ago, when the united people rose in rebellion and drove out their Chinese oppressors, placing themselves under the rule of a certain Yacúb Beg, a Kokandí of Andiján, a soldier of fortune, who, having fled before the Russians, came upon the scene at this fortunate moment. Yacúb Beg, or the Ameer—as he is now called in virtue of a firman from the Sultan,—has proved himself a very wise and able leader. He has repressed brigandage, encouraged trade, raised a very

decent military force, and generally strengthened and improved his country : his only fault, indeed, seems to have been a certain lust of territory, which has prompted him to extend his conquests too far to the eastward. Not content, indeed, with Aksu and Turfan, he has pushed on to Ooroomchí and Manas, across one of the spurs of the Thian-Shan, thus coming into contact with his old enemies the Chinese, who still hold Barkul and Hamil, and placing himself in a somewhat difficult relation with the Russians at Kulja.

Our first communications with this Chief were opened by Shaw and Hayward in 1868. Since then Mr. Forsyth, of the Bengal Civil Service, was deputed by Lord Mayo to Kashgar, but got no farther than Yarkand, owing to the chief being engaged in fighting the Tungans at Ooroomchí. During the last winter, Lord Northbrook has resumed the idea of opening out commercial relations with Turkestan, and has sent to Kashgar, under the direction of Mr. Forsyth, one of the best-appointed Missions that has left India since the days of Malcolm and Mountstuart Elphinstone. Lord Northbrook, indeed, greatly to his credit, seems to have recognised that, in visiting an almost unknown country, there are other things to be thought of besides political relations ; that it is, indeed, of almost equal interest and importance to investigate the geography and geology, and natural history of the country, to examine into its trade, and products, and manufactures, to collect information regarding its ethnology, and the religion and character, and manners and customs of the inhabitants. All these objects seem to have been duly cared for in the composition of the Mission, of whose reports, relating mainly to geography, I propose to read extracts to you this evening.

The first of these reports which I shall notice is one relating to a journey of 100 miles, made by a portion of Mr. Forsyth's party, to the north, from Kashgar, into the Russian territory. The great result of this journey, and one for which we have been watching for the last ten years, is that we have now joined our Indian trigonometrical system with the trigonometrical system of Russia. The two systems indeed now overlap by 40 miles. Mr. Trotter thus describes his journey :—

1. *Letter from Captain TROTTER, R.E., to the Right Hon. Sir BARTLE FRERE.*

" MY DEAR SIR BARTLE,

" Kashgar, January 24th, 1873.

" When sending you a few lines from Yarkand, I promised to write more at length, should I have an opportunity of leaving the beaten track or acquiring any really new geographical information.

I have recently returned from a trip to (Lake) Chadyr Kul, on the Russian frontier; our ground, which, although it has been traversed more than once by Russians, is, at all events, new to Englishmen.

"The British envoy, Mr. Forsyth, c.b., having secured permission from the King (or rather, I should say, the 'Ameer,' the title he has recently assumed) for the despatch of a semi-shooting, semi-exploring party towards the north, it was arranged that Dr. Stoliczka and myself should proceed in that direction under the leadership of Colonel Gordon. It was our first departure from the high road, and the authorities here were evidently a little fearful that they might not be able to restrain the roving propensities of so many foreigners, and so insisted before we left that we should trust entirely to their hospitality, instead of taking with us our own tents, baggage animals, &c. Being the King's guests, we had naturally to give way; the consequence of which was—doubtless as intended—that our movements were not so free as they would otherwise have been, and we were unable to carry out the complete programme of our leader, which included a visit to the Chadyr Kul, *via* the Chakmák Forts, then a journey eastward across the hills to the Terekty Forts and Pass, and thence back to Kashgar. As it was, we were only able to carry out the first part of the programme, and from Chadyr Kul we had to retrace our steps by the way we went.

"The trip, however, was very interesting, and specially so to myself, as representative of the Great Trigonometrical Survey of India, as the scientific surveys of Russia and England have now crossed each other in friendly rivalry, and the road from here to the crest of the Thian Shan is a link in the chain across Asia common to both countries.

"We left civilisation and our very comfortable quarters at Kashgar on the last day of the old year. The whole of our personal baggage was carried on six ponies. Tables, chairs, and such like luxuries being left behind. For the first two or three days, we were somewhat uncomfortable, and the official who was accompanying us appeared hardly to appreciate the importance an Englishman attaches to a sufficient supply of animal food. As we advanced we fared better in this respect, however; so, after the unbounded hospitality which we have experienced since entering the country, it is hardly fair to grumble.

"Our first day's march was 26 miles to Besák, a village in the Upper Artysh district. The road passes along the east wall of the city of Kashgar, which is distant about  $5\frac{1}{2}$  miles in a north-westerly direction from our residence, close by the Yangi-shahr or new city.

The Kona-shahr, or old city, which we have frequently visited since our arrival here, is not nearly so large as that of Yarkand, being under 3 miles in circumference, as against about  $3\frac{1}{2}$  at Yarkand; both cities are surrounded by a large mud wall, varying in places from 20 to 40 feet in height, and of great thickness, strengthened at numerous intervals by square towers. As both cities are built entirely of mud, they bear a family resemblance to one another, and there is not much room for comparison between the architectural beauties of the one and the other. Two branches of the Kizil Su, or Kashgar River, flow, the one on the north the other on the south of the city, meeting at a point about  $2\frac{1}{2}$  miles south-east of it. Both branches are crossed by well-constructed timber-bridges. At this season of the year there is very little water in either stream, and what little there is is mostly frozen, so that it is impossible to form an idea of the discharge during the spring, when, owing to the melting of the snows, the river is at its highest. After leaving the city and crossing the stream, the left bank of which is covered by tanneries and cemeteries, the road is nearly due north, and enters a narrow lane between two mud walls, on either side of which are enclosed gardens, fields, and hovels, which continue for some 4 miles, when the road emerges on to an open stony plain, forming a very gently-rising slope up to a small spur from a low range of hills running from north to east, and through a gap in which the River Artysh has forced its way; the road passes along the river-bed, through the range, and crossing to its north bank, we arrive in the wide and fertile valley of the Artysh—a name given to the whole district, which comprises several townships scattered over the valley—across which we pursued our way for several miles in a westerly direction, reaching soon after dark Besak, where we found a large room prepared for our reception. Here we passed the night, continuing our journey at about nine o'clock the following morning, still in a westerly direction. The first few miles we passed over fields, well irrigated from the upper branch of the Toyand River. This river, which flows from the Turgat Pass, divides into two branches, where it debouches into the plains in the Artysh Valley; the upper one flows nearly due east, and is the principal source of irrigation of this fertile plain. The south, or main branch, flows south-east into the River Artysh, which is said to rise in the Terek Duvan, on the road to Kokand. On entering the Toyand Valley, here about 2 miles wide, we may be said to have fairly entered the Thian Shan Mountains—the ridge we had crossed in our previous day's journey (and which at its highest part is only a few hundred feet above the plain) being rather an

isolated ridge than a portion of the main range. In marching up this open valley we had in our view on our left the rough serrated edges of the Ming-yol Hill—a prominent object in the panoramic view from the roof of the Embassy buildings in Kashgar, from which it has the appearance of a large isolated hill. On going partially round it, however, it appeared to be only the end of a long ridge of nearly uniform height running in a direction a little north of west, and of which I hope to learn more in subsequent explorations, as it lies in a most interesting spot in the angle formed by the junction of the Thian Shan with the Pamir and Alai Steppea. In continuing our march up the valley we saw in front, at a distance, however, of only a few miles, some snowy peaks, the same that are visible from Kashgar behind the Artysh ridge, and which thence appear to be peaks of the main range running south of the Chadyr Kul. They are not so, however, but form a lower range of hills running nearly parallel to the main range, i.e. from west to east. After a march of 20 miles, during which we passed on our right the old Chinese outpost of Tessek Tash (or Khitai [Chinese] Karawul), and 5 miles further on the village of Tapú. We arrived at about 4 o'clock at our camping-ground at Chüng Terek (big silver-poplar), a most picturesque spot, which at any other time of the year would have been most lovely. In the foreground a Kirghiz village, on one side of which, under some large poplar trees, were pitched for our accommodation a couple of akoocees, or felt-tents. In the background the valley suddenly narrowed and passed up a gorge overhung by very precipitous mountains, the highest of which was about 2700 feet above our camp, and whose dark outline against the sky formed a most perfect picture. Leaving this camp on the third day, we had another march of 21 miles to the Chakmák Forts, the road steadily up hill, a gentle, but regular ascent the whole march; in fact, this pass to Chadyr Kul is open to laden camels even in midwinter, the slope from the Artysh Valley, height about 5300, to the Turgat Pass, about 12,800 feet, a distance of 80 miles, being of a tolerably uniform slope throughout, and giving, therefore, a regular rise of about 100 feet per mile. The road is good all the way, and the only difficulties are where it crosses the stream, which, at this season of the year, is partially frozen over for almost its entire length.

"From a couple of miles north of our camp the valley narrows in places to a breadth of about 200 yards, and continues confined between steep precipitous hills for about 20 miles. At 10 miles from the commencement of this defile we reached the Fort of Mirza Terek, or Pas Kurgan (Lower Fort), a carefully-constructed

work, which would give a great deal of trouble to an enemy : both here and at Chakmák, 9 miles further up the stream, the over-hanging heights are so precipitous and inaccessible that it would be almost impossible for the enemy to effect a lodgment in them. The fort itself, which covers the entire breadth of the valley, about 250 yards, sweeps the whole of the approach, an advance along which would have to be made under very heavy direct fire for several hundred yards ; in addition to which, as he approaches the forts, he would be exposed to a very severe flank fire from a long wing wall built parallel to the course of the stream and entirely screened from view up the valley by a natural projecting barrier of rock. Two precipitous hills in the neighbourhood of the fort have small redoubts on top, which would materially aid the defence. A few miles further on we came to the Chakmák Forts, garrisoned by some 200 men ; a place which nature, aided by art, has made so strong that, if well defended by an energetic commander with good troops under his orders, it would probably be almost impregnable, and the outworks are so judiciously placed that, under any circumstances, an army would probably be delayed for several days by a very much inferior force. It is well for the Ameer of Kashgar that it is so, for the road across to the Russian frontier is so easy even in midwinter that there is no physical obstacle to the advance of a large army. On the south side of the Pass grass is everywhere procurable in moderate quantities, whilst near the Pass itself there is first-rate grazing ground frequented by large herds of Kirghiz ponies. We saw several hundreds, said to belong to the Kara Kirghiz from Almaty, subjects of Russia, but who pay a certain amount of tribute to the Ameer for the privilege of grazing in his territories during the winter months.

" Firewood is not so plentiful, and from Chakmák onwards has to be carried ; although at Balgham-bashee, about 10 miles to the north, a fuel of an inferior quality is to be found.

" There are two roads from the north converging on to a point a few miles north of these forts ; one from the Suyok Pass, 2 days' march in a north-westerly direction, is little more than a path, and cannot be traversed by horsemen ; but the road from the Turgat Pass, about 30 miles to the north of the junction, is used by laden camels, and is, in fact, the most used caravan-route from Almaty or Fort Vernoye. On leaving Chakmák our conductor tried to deter us from going on by warnings about the cold, and only took us to Balgham-bashee. The following day, however, we made a march of 15 miles to Turgat Bala, an interesting road, as, after passing through volcanic rocks, we came to a place where the banks,

rising to many hundreds of feet in perpendicular height, bore unmistakable signs of being the crater of an extinct volcano. Our geologist, Dr. Stoliczka, who had predicted the occurrence, was of course delighted. The sportsmen of the party now had their turn, and leaving the main valley for a gentle ravine on the west, we were taken for several miles over gently undulating grassy downs to a hill where we were promised great sport after the 'Ovis Poli,' well known by repute, doubtless, to most members of the Royal Geographical Society. Colonel Gordon and myself each got a shot, but the intense cold at this great elevation (about 13,000 feet) militated very much against us, and I regret to say that we failed to secure a specimen, although Colonel Gordon got two fingers badly frost-bitten from the cold contact of his rifle. We were accompanied for the day by some Kirghiz seploys of the King's, a large number of whom are attached to the Chakmák command; admirably mounted on the sturdy ponies \* for which the country is famous, good shots, and knowing each foot of the surrounding country, they would make splendid scouts and mountain soldiers in time of war. In the present time of profound peace they keep their ponies, hands, and eyes in capital training in hunting the 'Ovis Poli' or 'guljá,' the name by which it is here known. Within the last few days no less than 100 specimens of guljá and taká (ibex) have been distributed by the King amongst the poor in the city of Kashgar. We have ourselves several specimens that have been sent to us, whose skins and horns will doubtless some day find their way to Europe.

" You may perhaps think that ponies are somewhat out of place in this mountain warfare, and so I thought myself at first, and was somewhat surprised at the look of astonishment of my Kirghiz guide, when he saw me dismount and proceed on foot to stalk some animals that I had seen on a slope about a mile off. Later in the day I experienced their value, when asking the whereabouts of our camp, my guides pointed to the other side of a range to our north, and said there were two roads, one round the base of the hill, and the other over it; I naturally preferred the shorter one, but was somewhat taken aback when they mounted, and at once proceeded to scale the face of the mountain, going up a spur without any visible path, covered with a few inches of sand, and so steep that it was necessary to zigzag up the whole way—a height of

\* Our baggage-ponies all carried a couple of heavy trunks, with bedding, &c., piled over them; on the top of all squatted the pony attendant. Thus, with at least 400 lbs. on their back, they would steadily keep up for several hours, on end, an average pace of 4 miles per hour.

more than 1000 feet. Had we not *done* it, and arrived safely at the top and then descended an equally steep slope on the other side, I should have said that it was an impossible ride. As it was I could but change my opinion as to the utility of these mountain ponies. At the top of the ridge I had hoped to get a good view of the country around, but the evening was closing and the intense cold of the wind (north-west) so bitter, exceeding anything experienced on the Thibet plains on our journey to Yarkand, that halting on the top was quite out of the question, and in the few seconds that I delayed to record the reading of my aneroid my extremities became entirely numbed.

"Next day was devoted to Shikár ; and, although unsuccessful, I thoroughly enjoyed a very long day's work, and learned to stalk à la Kirghiz, the *modus operandi* being as follows : you leave camp after an early breakfast, with rifle slung on your shoulder, and mounted on a trusty pony, accompanied by a couple of mounted Kirghiz, who have their long matchlocks slung in similar manner. You wander along over hill and dale, always approaching a ridge very carefully, and peering cautiously over the edge. If game be seen, you drop back, and, after carefully reconnoitring the ground, hold a hasty consultation with your guides, and by the use of a good deal of pantomime and a few Turki words come to an understanding as to the mode of procedure to be adopted. Perhaps the ground is very open, and it will be necessary to dismount and stalk in the ordinary manner, with all the science and care necessary on such occasions. If, however, as is often the case, in going along a large, broad, open valley you see a herd disappear behind a ridge, perhaps a mile ahead of you, you exchange glances with your guides, and off you start as fast as your ponies will carry you—tearing along at full gallop, if the ground will admit of it—but somewhat modulating your pace if the ground be difficult or up-hill. Assuming that the herd is advancing quietly and at a moderate pace, you calculate the probable part of the ridge which they are likely to be behind at the time of your arrival, and never draw rein until you reach the spot just below the crest ; you then dismount and steal forward, and if your stalk has been judiciously made you get a capital chance. If successful, the guides' ponies carry home the spoil. The 'young men' who were with us brought in four—not bad for one day's work. The great beauty of this sport is the combination of the excitement of the gallop and the stalk, and the great quantity of ground that can be covered in a single day. We were shooting at one time at least 12 miles from camp. In the lower hills are the 'sheep,' and in a high, rocky range to the north ibex were said to

abound, but in ground where it would be impossible for even a Kirghiz pony to follow.

"In the evening I took some star observations for latitude, but you may imagine that I spent as little time over them as possible, considering that the thermometer was standing at  $10^{\circ}$  below zero Fahrenheit, with a bitter wind blowing and no shelter. At night the thermometer outside our akooee fell to  $26^{\circ}$ , while inside it went down to  $8\frac{1}{2}^{\circ}$ . We have a fire in the middle of our akooee when we turn in, which keeps us tolerably warm until we get to sleep; but our Hindustani servants must have had a hard time of it under a very thin canvas tent. Some poor unfortunates, our pony attendants, had to sleep in the open air; but really they did not seem much the worse for it. What struck me most, however, was the real piety displayed by our Mahomedan hosts (in which, however, I am sorry to say, our own servants did not join), as every morning at break of day we were woken by the call to prayers, and nearly every man in camp would turn out to worship, with the thermometer at  $25^{\circ}$  below zero. I had always hitherto somehow associated the Mahomedan religion with a warm climate, but certainly shall not do so again after the experience gained on this trip.

"On the following day (sixth from Kashgar) we rode out to the Chadyr Kul Lake and back to camp—a ride of about 32 miles. Starting early in the morning, with the thermometer several degrees below zero, we rode about 13 miles to the pass—a gentle ascent up the open valley until within a mile of the crest, when the rise, though still very easy, is somewhat steeper (about 400 feet in the last mile). We had a lovely day for the trip, and I was able to make careful observations for the height of the pass, which I make to be about 12,800 feet above sea-level (this is calculated from an assumed value of Kashgar of 4200 feet, and liable to subsequent alteration). Whilst boiling my thermometer, a solitary horseman appeared on the crest above, watching me intently. The Sepoy who was with me immediately said it was a 'Roos.' After exchanging a few words he retired, when I followed the rest of the party. On reaching the pass we did not come suddenly, as we had expected into view of the lake, but had to go along a spur for about 3 miles in a northerly direction, when we burst suddenly into full view of the lake and the Tash Robat Mountains beyond—a magnificent panorama, to which full justice had been done in a sketch by Colonel Gordon while waiting for me to come up. We had hoped to have descended to the shores of the lake, but the official who was with us was evidently somewhat in doubt as to the ownership of the country—whether it belonged to the Ak Padsháh, or to Jenáb 'Ali (as the

Ameer is always called by his people); and as we had received instructions not to pass the frontier line, we were obliged to content ourselves with this bird's-eye view of it. Of course, viewing the lake and mountains beyond from only a single point, it was impossible to form any accurate idea as to its size, but the Russian maps make it to be an oblong, about 14 miles in length from west to east, and 5 or 6 miles in breadth. From the place where we stood, about 3 miles north of the pass, the eastern extremity of the lake bore a little to the west of north, while the Tash Robat Pass, as pointed out by our guides, lay about  $17^{\circ}$  further to the west. The lake itself, which is about 1500 feet below the pass, was covered with ice, and the sleet which lay on the top made it difficult to distinguish between it and the nearly level plain by which it is surrounded, and which was covered by a white saline efflorescence. A single horseman, near the edge of the lake, was the only living object visible—a curious contrast to the other side of the pass, where, within a few miles, we had left a herd of several hundred ponies grazing on the slopes at the foot of the precipitous hills forming the crest of the range. These extensive grassy slopes, somewhat resembling the English downs, are a very curious feature in the country, and attract not only the large flocks of *Guljas* (in one of which Dr. Stoliczka counted no less than eighty-five), but are equally attractive to the Kirghiz as grazing ground for their horses.

"Looking from our elevated position above the lake, there appeared to be two ranges of mountains—the Turgat, on a spur of which we were standing, and the Tash Robat, on the opposite side of the lake. Both are portions of the Thian Shan range, which westward, like the Karakorum eastward, seems to lose its identity, and merges into several comparatively unimportant minor chains, of which it is impossible to say which is the main one. Hence there is some difficulty in defining the watershed, and consequently the boundary between Russia and Kashgar. The Chadyr Kul Lake lies between the two ridges, and, as far as I can learn from observation and from the Russian map I have seen, there is no drainage out of it, although several small streams run into it. The map includes the lake within the Russian boundary, which they place on the crest of the south or Turgat range, the peaks and passes of which are apparently of the same average height as the northern range. The authorities in Kashgar claim the lake, and maintain that the Tash Robat is the true boundary; but the officials on the spot seemed to take a third view, viz., that the lake itself was the boundary. The Ak-sai River, which rises between the ranges a few miles east of the lake, flows into Turkistan, while the Arpa, rising in a cor-

responding position near the west end of the lake, finds its way into the Syr or Jaxartes River. This would indicate the lake itself as a good natural boundary, the crest of the Tash Robat on the east, and that of the Turgat River on the west completing the line.

"The general run of the crest of the Turgat range is, as far as I could judge, from west to east, although a few miles west of the pass it takes a decided bend to the north-east: the peaks also decrease in height as the range approaches the pass; the highest, within a few miles of it, being about 15,000 feet; others, away to the west, being apparently a couple of thousand feet or more higher. East of the pass again the hills are still lower, and it was impossible to judge of their general direction, though from the Russian maps it would appear to run in a south-east direction. I had hoped that we should have been allowed to cross the mountains, or rather high undulating table-lands, eastwards, and thus get a very complete idea of the whole range; but the officials seemed to think we had seen quite enough, and we had to return to Kashgar. This was of course much to be regretted from a geographical point of view; but, on the other hand, we ought to be duly grateful for having been allowed to stir out of Kashgar at all—a concession on the part of the King which our friends in Hindustan best acquainted with the country and its ways certainly did not lead us to expect. As it is, we have broken the ice, and there is every hope that opportunity will be given during the next few months for a vast increase to our store of geographical knowledge.

"HENRY TROTTER."

Sir Henry then continued: The discovery of an extinct crater on the outer skirts of the Thian-Shan, alluded to in this letter, is a most important addition to our knowledge of the physical geography of the region. It confirms what the great Humboldt always maintained with regard to the Thian-Shan, but what the Russian geographers have recently denied. Severtsoff, in particular, whose paper was published in a recent number of our 'Journal,' asserted that there was no trace of volcanic agency in the Thian-Shan. (See 'Journal of the Royal Geographical Society,' vol. xl. p. 395.)

The next Report which I shall read to you has reference to a trip made by Captain Biddulph to the eastward of Kashgar. This is all entirely new ground, which has never before been travelled by any European. Many of the names of places mentioned are very important and curious. Captain Biddulph's report indeed contains the first really authentic notice I have seen of the name of

Yamanyar, as applied to one of the Kashgar rivers. It would be inconvenient at present to take up the old question of the fictitious travels of the German Baron; but one of the test-points of those travels was this Yamanyar River, supposed to pass to the south of Kashgar. I had always supposed that the name of Yamanyar (stated in the Foreign-Office MS. to mean "having bad banks") was an invention by the author of those fictitious works; but I now find that the name really does exist, and I can only suppose, therefore, that Klaproth, who is now pretty well ascertained to be the author of all those fictitious travels, obtained the name from some of the Chinese authorities.

2. *Report of Trip from Kashgar to Maralbashee.* By Captain  
J. BIDDULPH.

"Kashgar, 4th February, 1874.

"The Ameer's permission for my going to Maralbashee having been obtained, I left Yengi Shahr on 31st December, 1873, Mirza Suffee Punjabashee being deputed by the Ameer to accompany me.

"Travelling easily, I reached Maralbashee in seven marches. The road runs for the entire distance along the course of the Kashgar River, or Kizzil Su, which it crosses about 60 miles from Yengi Shahr. For the first 40 miles the country is well cultivated, and there is no want of population; the town of Fyzabad, which gives its name to a flourishing district, being reached at 35 miles' distance from Kashgar.

"At a little more than half-way from Yengi Shahr to Fyzabad, the road crosses three considerable streams flowing from the south into the Kizzil River. Their names were given me as the Derbuchek, the Chokanah, and the Fyzabad, and I was told that they are all united into one stream, called the Yamanyar, at no great distance above where I crossed them. Beyond Fyzabad habitations become scarcer, and cease altogether at Yengi Awat, 46 miles from Kashgar. From here the country is covered with low bush-jungle and sand-hills, gradually changing to forest, which becomes continuous shortly after crossing the Kizzil Su to within 4 miles of Maralbashee. No habitations are met with during the whole of this distance except posthouses, at intervals of about 15 miles, which are erected for the use of travellers. These are all of inferior construction, with small accommodation, one of them only consisting of a single room. As I took no tents with me, I used the posthouses during the whole time of my absence from Yengi Shahr. The forest, though apparently of great extent, contains no fine timber, the only tree being the poplar (*Tograk*), of stunted growth; the undergrowth consisting of a bush,

growing to a height of about 8 feet, a thorny bramble, and camel-thorn, but there is no grass; the soil is very dry, alluvial, and covered with a thin hard crust of soda, which crackles under the foot at every step, and in which horses sink up to the fetlocks. The forest abounds with gazelles (*Antilope gutturosa*) and hares, but, with these exceptions, is singularly wanting in animal life. For a space of about three-quarters of a mile on each side of the river there are no trees, but in their stead a belt of thick high grass, like what is known in Indian jungles as lurkut, growing to a height of from 8 feet to 12 feet. In this are tigers, wolves, the large deer, called by the natives 'Bugha' or 'Maral' (apparently *Cervus elaphus*), gazelles, foxes, and pheasants. This treeless belt is doubtless caused by periodical changes of the river-bed, of which there are many evidences; the fall of the country to the eastward being only a little over 500 feet in 100 miles, according to aneroid readings which I took daily, the river making frequent turns and windings, and being level with its banks, so that a very slight flush of water would cause an overflow—the current not being rapid enough to prevent its freezing sufficiently to admit of loaded carts crossing it with ease. In summer it is crossed by a bridge, which, however, I did not see, as the road I followed, both in coming and going, is more direct, thereby saving several miles, and is always used in winter. Within 4 miles of Maralbashee the forest ceases, and the country is covered with long grass, with occasional patches of scrub and swamp, much resembling the Rohilcund Terai. In this are dotted about small villages, with patches of cultivation round them. The grass jungle extends over a great extent of country, as well as I could gather, both to the north-east, south-west, and eastward, being, doubtless, formed by overflows and changes of course of the Kizzil and Yarkund rivers. The latter river, I was informed, flows close to Aksak-maral, which is about 32 miles south-west of Maralbashee.

"Maralbashee, or Burchuk, as it is sometimes called, contains about 1500 inhabitants, and is at the junction of the road from Yarkand with the Kashgar and Aksu road. It contains a fort and small garrison of about 200 men; it could, however, from its position, be easily and quickly reinforced, either from Aksu, Kashgar, or Yarkand, if necessary. The River Kizzil flows under the walls of the fort, and during the late rebellion against the Chinese was made use of by being dammed up and turned on to the fort to break down the wall. Where I crossed it on the road from Kashgar it is 100 feet wide, level with the bank, but flows here in a greatly diminished stream, about 25 feet wide, between high banks, 20 feet below the level of the surrounding country. Its character was so

altered, that it was only after repeated assurances from the natives that I satisfied myself as to its being the same stream.

"The Hakim Beg, of Maralbashee district, has the title of Dadkhwah : the present one, by name Ata Bai, is an Andijani. He is a man of about 35 years of age, with especially pleasant address, and seems much liked by the people, who all speak highly of him.

"The natives of the district are called Dolans : they have a more Tartar-like cast of countenance than Yarkandees and Kashgarees, and are said to be distinguished for their fondness for music and singing. They are said to be descendants of prisoners brought in the fourth century of the Hejra by Harown Bugra Khan from Mowralnahr, and forcibly settled in the country between Maralbashee and Kuchar. In the jungle villages they excavate houses out of the ground, making grass roofs level with the surface. The term Dolan is applied generally to men of mixed parentage.

"The fort is of the same kind as others we have seen in the country, with earthen rampart, about 30 feet thick and 25 feet high, a low parapet, forming a kind of covered way, and ditch : it forms a square of about 170 yards, with projecting circular bastions at the angles, three of them having square towers on them ; also a circular bastion in the centre of each face. Close outside the fort is a palace lately built by the Ameer.

"Nine miles to the north-east of Maralbashee is a huge black rock, with treble peak, rising to a height of some 2500 feet above the plain, apparently basaltic : it is very rugged and quite inaccessible, and forms a conspicuous landmark. It is called 'Pir Shereh Kuddam Moortaza Ali Tagh.' At its foot on the north side is a Mazar of great sanctity. The Aksu road runs within a mile of it, and travellers, on catching sight of the shrine, dismount and say a prayer.

"Four days after my arrival at Maralbashee, the Dadkhwah Ata Bai came in from Ooroomchi, after an absence of ten months : he had with him about 120 men, and had been present at the recent fighting at Manas. I was told that a great number of desertions had taken place from the army : upwards of 400 men, it was said, had deserted into Russian territory. Of the contingent from Maralbashee, four had been killed and twenty had deserted.

"From Maralbashee I went to Charwagh, the first stage on the Aksu road, a village of about 250 inhabitants, and spent several days in shooting and hawking. I was especially anxious to shoot a tiger, of which there are many about, but was unsuccessful in the sea of high grass with which the country is covered. From signs which I was shown, and footprints which are common everywhere,

and judging by what I was told, there is no doubt that the tiger here is altogether a smaller animal than his Indian congener; he seems also to differ considerably in his habits, prowling round villages at night, killing dogs and sheep, and behaving more like an Indian panther than a tiger. The natives spoke of men being killed by tigers occasionally; but it does not appear to be a common occurrence.

"The jungle abounds with pheasants, which gave good sport with hawks; and I also saw the burgoots, or trained eagles, kill gazelles and foxes. I was not fortunate enough to see a wolf killed by them; but from the great ease with which an eagle disposes of a full-grown fox, I could see that a wolf would have no better chance. Grasping with one powerful talon the throat of his victim, the burgoot seizes his jaws with the other, keeping them closed with an iron grasp, so that the animal is powerless. Gazelles are seized in the same way, except those with horns, in which case the eagle first fastens on to the loins of the animal, and watching his opportunity, transfers his grasp to the throat, avoiding the horns. It is a fine sight to see the great birds sweeping up to their prey.

"I saw at Maralbashee a Punjabee, serving as a soldier, who gave me much interesting information, which I have recorded elsewhere. The country round Maralbashee is well watered, and the soil rich, and seems only to want population. There are many traces of old cultivation now overgrown with jungle.

"I left Charwagh on the 16th, and returned to Kashgar on the 23rd January by the same road which I went by. I was invited to go further along the Aksu road, and believe that no difficulty would have been made about my going to Aksu itself, as during the whole time I was absent from Kashgar no attempt was made in any way to control or direct my movements. I received whatever supplies I was in need of, and was treated by all officials with the greatest civility. On one occasion a Moolla, having forced his way into my room and asked me for a turban, was severely punished by the Governor."

Sir Henry went on to explain, that on the return of the Mission from Kashgar, Mr. Forsyth detached a party, under Col. Gordon, from Yengi-Hissar to cross the Pamir to Wakhan in the hope that they might be able to continue their route to India, either by Yassin and Gilghit, or by the Chitral valley, or, finally, by the beaten track through Badakhshan and Kunduz, and across the Hindú-kúsh to Cabul; but on arriving at Kila Panja, where the two upper arms of the Oxus unite, they found that, owing to



Map of the  
**PAMIR STEPPE**  
and Neighbouring Districts

*to illustrate the letters  
of Colonel Gordon & Members  
of the Kashgar Mission*



Authors Route \_\_\_\_\_

troubles in Afghanistan, their further progress in that direction was barred; and they were accordingly obliged to retrace their steps to Tash-kurghan, in order to rejoin the Mission on its march through Thibet. Sir Henry then read the following extracts from four different letters written by members of Colonel Gordon's party from Kila Panja.

*3. From Colonel GORDON to Mr. AITCHISON.*

"DEAR MR. AITCHISON,—

"Kila Panja, Wakhan,

"April 14th, 1874.

"I arrived here yesterday, accompanied by Captains Bidulph and Trotter and Dr. Stoliczka, travelling from Yengi Hissar by Serikol and the Pamir Khurd. We left Yengi Hissar on the 21st March, and Serikol on the 2nd inst. I may say that the whole journey has been made through snow more or less. It lay very deep on the Pamir, and as the marches were long there (25 miles), the hard work has reduced our baggage animals considerably, so much so that a rest of ten or twelve days here is absolutely necessary before they can be fit for further travelling. A severe snow-storm overtook us the day we reached Sarhadd (the 8th inst.), and we had it in our faces for two marches down. The storm appears to have reached far below this place. We had repeated snowfalls throughout the journey from Yengi Hissar, adding greatly to the severity of the weather caused by the unusual lateness of the winter this year. We had a heavy snowfall in Kashgar a few days before we left, and that fall appears to have been general all over the mountains and highlands here. The Toksabai (governor) of Serikol warned us of what we might expect in the way of snow on the Pamir, and we found it as he said. The Ameer of Kashgar went to great expense in laying out supplies for us the whole way from Yengi Hissar, and across the Pamir to Sarhadd; yaks and ponies accompanying us with them the latter portion of the journey.

"The Resaldar starts to-morrow morning, and should reach Faizabad on the 18th. I expect him back about the 23rd. In the mean time I will be making all ready for the return journey over the Pamir. I am greatly afraid that the extreme lateness of the winter, and the recent heavy snowfall, will prevent us taking the road by Wood's Lake.

"The Meer says that it is impracticable at present, the snow being up to a horse's girth, and that it will remain so for six weeks to come. However, he has consented to send two men with one of my people off to-morrow to go as far as possible to the lake (four days),

and report on the state of the roads. Regarding the information we have obtained on and about the Pamir, I would refer you to a sketch map and accompanying explanation Biddulph is now despatching in the same packet with this to Colonel Earle.

"The map represents all our discoveries so far: You will see by it that the *whole of the road to India* from Khokan lies through the Atalik's and the Meer of Wakhan's dominions. From Yengi Hissar to Serikol the road is bad; thence to the Pamir Khurd Kol good; after that bad almost the whole way to this; but, I believe, that from the Kizil Yurt Pass to this, by the Great Pamir, it is good, with grass in abundance.

"But there is then the very bad bit from this to Sarhadd (55 miles), whence the easy Barajhil Pass is approached. Wakhan is a very poor country, inhabited by about 300 families. Though poor, however, they are proud of their descent from 'Sikandar.'

"I found and sketched some very interesting 'Greek remains' in a hut in which we all lodged (without disturbing the family) for a night during a severe snowstorm. Our latest news from Mr. Forsyth is dated 29th March. We cannot expect at this distance to hear often or regularly. If we leave this on the 24th or 25th we may expect to reach Leh about the middle of July. This allows for short halts on the way, to rest and recruit the baggage animals. My party here consists of 48 men and 72 ponies, inclusive of 6 men and 7 ponies belonging to Kashgar. A party of this strength is increased considerably, of course, when 12 or 13 days' supplies accompany. Our journey hitherto has been made without any serious loss, illness, or accident.

"T. E. GORDON."

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4. *From Captain BIDDULPH to Colonel BIDDULPH, R.A.*

"Kila Panja, Wakhan,  
"April 14th, 1874.

"This, if it reaches you at all, will arrive considerably before the letters I have written to you from Kashgar, so I will recapitulate our movements. We left Kashgar on the 17th March, and after two days at Yengi Hissar, Gordon, Trotter, Stoliczka, and self, came on here, and arrived yesterday. We had an uncommonly rough time of it, having been travelling in snow, with bad weather, from the day of leaving till now. The cold was not so severe as on the Karakorum; but the great amount of snow creates much discomfort, and cuts our faces about tremendously.

"We came through Sirikol, Tashkurgan, to Aktash, and over the Little Pamir, by the lake marked on the map as Burkut Yassin, though the name is a pure invention. The Pamir is not, as far as we can gather, a great steppe which can be traversed in any direction, but consists of a series of broad, elevated valleys, along which the different routes run. The way we came is the winter route, the elevation being 13,000 feet; but we had to cross four passes between Yengi Hissar before getting on to the Pamir. It appears that the drainage of the Pamir is all to the west, the Pamir itself not being the true watershed, but the Kizzilyart Plain, extending from north of Tashkurgan to the Alai, belonging to the Ameer of Kashgar. We have also solved the drainage of the Karakul, which has hitherto been a favourite subject of geographical discussion. There are two Karakuls, one draining east and one west. The most important geographical fact we have ascertained, though, is that the uninhabited parts we have come over, instead of belonging to nobody, are the property of the Meer of Wakhan, our present host, whose boundary marches with that of the Ameer of Kashgar.

"I send you a map, which will give you a fair idea of the drainage and boundaries.

"Luckily the Meer of this place is very civil, and gives us all we want, or we might be in a fix, as our animals are so broken down that they require a fortnight's rest before we can face the Pamir. We hope to go back over the Great Pamir by Wood's Lake; but they tell us it is impossible on account of the snow, of which more has fallen this year than usual, so we are sending two men to see. These tributaries of Shere Ali are very independent fellows. It is, however, a most miserable country; has only about 1000 inhabitants, all most wretchedly poor. Meer Futteh Ali Shah, a very feeble old man, is at present in great straits, having a remorseless creditor sitting on his head for the sum of 400 rupees. We are thinking of paying off his national debt, and so earning his eternal gratitude. We saw great herds of *Ovis Poli* on the Pamir, and their great horns were sticking out of the snow at every step. Shooting, however, was quite out of the question, as we were marching 25 miles a day, and the snowdrifts were so deep that walking out of the beaten track was almost impossible. I shall have a try, though, on the way back. There are no yak on the Pamir, but there are bears, and quantities of wolves. We had to carry firewood for seven marches, and grain the whole way. The celebrated Pamir grass, which is very fine and sweet, is all dried up, besides being covered with snow. If our Aksu trip had come

off, as it ought, we should have come over comfortably at a better time of year. I calculate we shall be in Leh about 1st July, but with the Pamir and Karakorum before us, and the constant snow and ice we have had since 15th September, I feel as if summer was never to come again. There are ibex near here, but we have had such a knocking about that I am glad of a few days' rest. If, however, the weather is favourable, in about four or five days I shall make an attempt. They are the black kind, different from the Cashmere ibex. By-the-by we found an Englishman in Kashgar living in miserable poverty. We noticed a man with an English face hanging about our gates from the first day. He called himself a Nogai Tartar, and said he had been in the Russian service. The day we came away we were hard up for mule drivers, and, as he was hanging about as usual, we took him on. At Yengi Hissar, while Gordon was sketching, the man came behind him, and, crowding in with others looking over G.'s shoulder, began unconsciously to read what was written under the sketches. G. encouraged him to go on, and, after he had read a bit, G. said, 'Ah, you're an Englishman.' On which he put his hands to his face, and ran right away, and we never saw him again. He is, doubtless, an old Crimean deserter, and dare not acknowledge himself.

"The Pamir could easily be crossed by guns, but the approaches to it on each side are bad. Guns could also come all the way down the Kizzilyart Plain, and over the Tagharma and Kizzilyart passes with ease. Still it cannot be too distinctly understood that all the people in these parts are friendly to us.

"This goes via Cabul."

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5. *Extracts of a Letter from Captain TROTTER, R.E.*

"Panja, Wakhan, April 14th, 1874.

"Here I am in the heart of Central Asia, but going back again to Yarkand, I am sorry to say, instead of going on to Cabul.

"The place I am writing from is that from which Wood made his ascent to Lake Victoria, and the Meer of which had his brains knocked out in Durbar, by order of the Meer of Kunduz, professedly for having been uncivil to Wood. You will be glad to hear that the present ruler, a near relative of the last, has been uncommonly civil to us, and is therefore not likely to receive a similar punishment. I am sending these few lines through Cabul with letters we are forwarding to the British Representative there. If they reach safely, they will probably anticipate by several weeks, or perhaps months, any other news you may receive of us.

" We have had a very trying journey across the Pamir. We are about twenty days' march from Yengi Hissar (between Kashgar and Yarkand), and are, as the crow flies, not more than 220 miles from Peshawur in the Punjab, and yet political difficulties prevent us returning to India, except by Yarkand and Ladakh. We are obliged to stay here to recruit the strength of our baggage ponies, before we commence the return journey. We have had five passes to cross during our twenty days' march, besides three or four days' travelling over the 'Roof of the World,' as it is popularly called, which was entirely under snow. Fortunately for us, the weather, while crossing, was fine, although the wind was intensely bitter; but on descending through the Wakhan Valley we have had snow falling every day, and altogether had a very hard time of it, although happily we are none of us any the worse for it, except that we have lost all the skin off our noses. We have only received two lots of mails from India during several months past, the roads over the Himalayas being closed by snow. We expect to be back in Yarkand about May 20th, and shall probably be in Ladakh early in July, and back at Simla some time in August. We have, however, a good deal of exposure to sun and heat, snow, wind, rain, hail, and cold, to go through 'twixt this and then. I have not had a day's illness since leaving Cashmere, and hope to be equally fortunate during the return journey.

" Our party consists of four,—Colonel Gordon, Biddulph, Dr. Stoliczka, and myself,—and we are necessarily encumbered with much baggage, and more than fifty ponies, so that we cannot move except with great previous preparation. Wakhan is a very poor country, and we find that we shall have considerable difficulty in provisioning ourselves for the journey back to Sirikol, half-way to Yarkand. We were guests of the Ameer of Kashgar till we arrived in the inhabited portions of the Wakhan Valley (about four marches from here), although his territory only extends to about two marches on the side of Sirikol. Wakhan is a province of Badakhshan, and is therefore the most eastern portion of the territories of the Ameer of Cabul, so the two monarchs between them have a goodly strip of territory from Herat on the west to Ooroomchi and Turfan on the east.

" We hear that a Russian Embassy arrived at Kashgar a few days after we vacated our quarters there, but have heard no news since we left Yengi Hissar."

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6. *Copy of a Letter from Captain J. BIDDULPH, Aide-de-Camp to the Viceroy on Yarkand Mission, to Colonel W. EARLE.*

"Kila Panja, 14th April, 1874.

"Here we are in Wakhan, having arrived here yesterday. As you are not likely to get our letters from Kashgar till some time after this should arrive, I will recapitulate our movements. We left Kashgar 17th March, our Aksu trip being ignored in a curious way though the Ameer had given his permission for it. After a two days' stay at Yengi Hissar, we—that is, Gordon, Trotter, Stoliczka, and self—left on 21st for Sirikol, which we reached on 30th, and, after two days, came on across the Little Pamir here. With the exception of the first day we have been travelling in snow the whole way, and have had an uncommonly rough time of it. Before we reached Tashkurgan we crossed three passes, which will give you some idea of the ground, and of course the Pamir itself was wild and desolate, and what little firewood we could get had to be dug up from under the snow. All supplies were brought with us, sent by the Ameer, whose liberality all through has been unbounded. We had sent on Mahomed Afzul ahead of us to announce our coming, and found Mir Futteh, Ali Shah's son, ready to meet us at the first village. Of course they had not expected us, and were in a great state at our coming, but finding that we wish to pay our way and will not eat them up, they are more satisfied; but you can hardly imagine a more miserable country, there are not more than a thousand inhabitants, and the climate is so severe that for five months they never go out of their houses, except to collect firewood. Futteh Ali Shah is a very feeble old man, very ill, and just now much oppressed by a debt of Rs. 400, for which he has an inexorable creditor living on him. We are thinking of paying off the national debt and thereby earning eternal gratitude. The people are peaceable and *Gurreeb*, and have a great respect for the *Dowlut* (English Government). We have just got a despatch from Cabul, written, of course, before they knew of our leaving Kashgar, and are sorry to find that there is no chance of our going back that way; so we shall load up and start back for Yarkand, across the Great Pamir by Wood's Lake, but shall require ten days here first to repair damages and prepare for the journey, as our cattle have suffered considerably, and the Great Pamir is 2000 feet higher than the little one.

"We have got some rather important information about the geography of these parts. The uninhabited tract that we have just traversed, instead of being a 'no man's land' as had always been

imagined, belongs to the Mir of Wakhan, who joins hands with the Ameer of Kashgar, within two marches of Sirikol. This is also acknowledged in Kashgar, and is a well-known fact to travellers and others, and there seems no doubt about it. The real watershed between the east and west is the Kizzilyart Plain, which belongs to Kashgar. I send you a rough map which will show you how the rivers run, quite differently to what has been hitherto accepted; the proportions are a little out, but otherwise it will give you a good idea of boundaries, &c. The Pamir, instead of being a steppe which you can march across in any direction, consists, as far as we can make out, of a series of broad valleys at a great elevation, called by the names of different Pamirs, along which the different roads run. The whole way from Aktash to Sarhud, four days' march, we were in one broad valley, there being no perceptible rise between the lake and the commencement of the waters flowing west. We saw great herds of *Ovis Poli*, and at every step their gigantic horns were sticking up out of the snow, but there was no possibility of stopping to shoot, and our marches were so long that we were obliged to start our baggage animals off before light, and they effectually frightened all the game off the road."

*Summary of Results of the Pamir Excursion, enclosed in Colonel BIDDULPH'S Letter.*

" There are two Karakul Lakes, one flowing east, and one flowing west. The one flowing east from the Ghiz stream and passing through the Ghiz Dawan, becomes the Kashgar River. The one flowing west joins the stream from the Ghaz Lake or Pamir Kul, and forms the Murghabi River, enters Shignan at Burtang, and traversing Shignan falls into the Oxus at Vamir, five days' journey below Kila Panja.

" Shignan is perfectly independent, ruled over by Yussuf Ali Shah, who also owns Roshan and adjoining Pamir.

" Wakhan territory extends up to junction of Aktash stream with stream flowing from Lake Karakul, and contains the Great, Little, and Alichur Pamirs.

" The true watershed between east and west is the Kizzilyart Plain belonging to the Ameer of Kashgar.

" The Shignan Pamir and the Kizzilyart Plain are inhabited by wandering Kirghiz, the other Pamirs have been abandoned of late years.

" From Tashkurgan to Small Karakul Lake is one day's march,

from Small Karakul to Great Karakul is five days, and to Osh from Great Karakul is six days' march.

"The Barogil Pass into Chitral is extremely easy and open the whole year, with the exception of about six weeks in March and April."

Sir Henry then continued as follows : I may observe, with regard to the information we now receive that there are two lakes named *Karakul*, that Mr. Shaw had previously assured us of the same fact.\* Captain Biddulph's letter incidentally mentions that they still believe in the country that Wood's Lake is at least 2000 feet higher than the southern lake : Wood having made his lake by boiling water 15,600 feet; while the Great Pamir Lake was determined by the Mirza, also by boiling water, to be 13,260 feet, so that there would seem to be nearly 2400 feet of difference between them. This difference of level has been hitherto accepted as a well ascertained geographical fact ; but there now seems good reason to doubt it. The water, indeed, from this lower lake runs first to the eastward, till it joins the stream of Aktash, after which it turns to the north-west, and passes at the back of the Great Pamir, so that if the latter were really 2400 feet higher than the Lesser Pamir, the water would be running up-hill. The only possible explanation of such an anomaly would be to suppose that the Great Pamir were an isolated plateau, raised 2000 or 3000 feet above the surrounding steppe, but the routes do not give any such indication. On the contrary, Feiz Bukhsh passes along a level plain from Wood's lake to Isligh, where the drainage of the Lesser Pamir passes to the Northwest ('Journal of the Royal Geographical Society,' vol. xlii. p. 465); and Mahomed Amin's route, given in Davies's Reports (Appendix, p. 367), describes the route as passing between two sections of the insulated Pamir Chain. My expectation, therefore, is, that if Col. Gordon's party are able to return by Wood's Lake, they will find the height of the Great Pamir to have been much exaggerated. In the mean time it is curious to observe that Captain Biddulph, in his letter to his brother, takes it for granted that the levels are right, and says that the lake that they will cross in the Great Pamir will be 2000 feet higher than the other.

Those Fellows of the Society who remember the discussions of last year with regard to Wakhan and Shignan, will be interested to find that the real country of Shignan is the valley of this river of Aktash, which, after its junction with a stream from Lake Karakul,

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\* See 'High Tartary,' p. 461.

takes the name of Murghábi (as already known from Abdul Mejid's route) and enters the Oxus at Vamir. It is also of importance to remark that Colonel Gordon confirms Abdul Mejid's statement that the Wakhan country extends as far North as the Murghábi, where it marches with Kokand, so that there is no intermediate Pamir Steppe held by independent Kirghiz.

Sir GEORGE CAMPBELL said he had been extremely interested in the accounts which had been given,—on the one hand by the Secretary to the American Embassy of the discoveries on the Russian side, and on the other hand by Sir H. Rawlinson of the discoveries on the British side. It was quite a surprise to find in such an almost unknown place as Wakhan a ruler who was friendly, civilised, and peaceable, and that the inhabitants of the great mountains and steppes were also friendly. He could see no reason why our contact with the Russians should be otherwise than peaceable and friendly. There need be no fear of the armies of the two nations marching against each other over snowy passes 18,000 to 19,000 feet high; but he hoped that the energy of the English and Russians would extend commerce and friendly intercourse.

Mr. DREW expressed his great admiration of the ability with which the Yarkand Mission had been carried out. When he considered the time of the year when some of the journeys were made, and the great elevations to which the travellers had ascended, he could not help being struck by the power of endurance, and the great energy which the officers had shown. From the first start from the Punjab exceeding care and ability had been displayed by the leaders of the expedition as well as by the Government, and the journey had been carried through with perfect success, partly due to the admirable arrangements made with regard to the baggage-animals, and partly to the exertions and good management of his friend Mr. Johnson, Governor at Leh under the Maharajah of Cashmere. The Embassy received the hospitable treatment which everybody expected from the Atalik Ghazee, and when the full accounts were made public no doubt exceedingly valuable information would be obtained. He wished to ask if the watershed between the basin of the Kashgar River and the basin of the Sir Daria was at the furthest point which the travellers reached, or at the point which they had fixed as the boundary. He also wished to know to what extent, and with what accuracy, the measurements from the southern side had been united to those of the northern side.

The CHAIRMAN said the real watershed seemed to be the Chadyr-kul Lake itself, for between the two ranges—the southern being called the Turgat range, and the northern the Tash Robat range—one stream flowed westward to the Jaxartes, and the other eastward to the Kashgar River. There was no water, however, flowing from that valley directly south to Kashgar. It was only from the southern slope of the Turgat range that the Artush River, the upper branch of which was called the Toyand, flowed down south to the Kashgar River. The Aksu River, which rose to the north of the Turgat range, joined very much further to the east. No details had yet been received as to the triangulation. The Expedition had intended to keep up a rough series of triangles by the peaks to the westward as they went along from Yarkand to Yengi Hissar, and so on to Kashgar; but, as they would have no objects to the right by which to correct their triangles, the triangulation would not of course be rigidly accurate. However, Captain Trotter had stated that the scientific surveys of Russia and England had now crossed each other, the distance from Teshek-tash to Chadyr-kul being common to the two surveys, so that it might now be considered that a series of triangles, more or less to be depended on, had been obtained from Archangel to Cape Comorin. The term Atalik Ghazee, he might add,

was no longer applicable; for Yakoob Beg had received the title of Ameer of Kashgar direct from the Sultan of Turkey, and that was the only name by which he proposed to be known in future. The treaty which was negotiated by Mr. Forsyth, and which was very much of the same character as that previously negotiated with Russia, simply providing that the trade between India and Kashgar should be carried on at an *ad valorem* import duty of 2½ per cent. on merchandise entering the country, had been ratified by the Governor-General, and sent back to Kashgar under the charge of Mr. Shaw, who was by this time well on his way to Turkestan. Whether Mr. Shaw would or would not remain at Kashgar as representative of the British Government would probably depend on the movements of the Ameer. If he was engaged in war on the eastern frontier, Mr. Shaw would no doubt return, but he would remain in Kashgar and Yarkand as long as the Ameer was there. Nothing definite, however, was known as to that point, but the treaty provided for a permanent Agent at the discretion of the Government.

Mr. SCHUYLER said the terminations *kand* or *kent*, which were so frequently found in Central Asia, were merely different forms of one thing, and meant "town." In the Toorki language there was what is called the harmony of the vowels. If the vowel of the first syllable were broad, the termination would be *kand*; if close, it would be *kend* or *kent*. Tashkent was incorrect, though consecrated by usage; it should be Taskand—Stone-town. He had always heard in Central Asia Yarkand, not Yarkund, which was the Indian pronunciation; from *yar*, a steep bank, and *kand*, town. The word Karakul was frequently applied to a lake. *Kul* meant lake; *kara*, black, and *Kara-kul* was applied almost indiscriminately to lakes by the Kirghiz and Usbega. If there was no special name for a lake, it was always a *karakul*, and that name is found in all parts of Central Asia. In the same way the word *Aksu* occurred as the name of a river. *Ak* meant white; *su*, water; and in every part of Central Asia there were rivers known to Europeans as *Aksu*, though they were not known to the natives by any particular names at all. There were a number of similar names, merely appellative. He knew one Russian colonel who asked near Khojent the name of a certain small range of mountains, and the Kirghiz replied, "God knows," and the Russian immediately marked the mountains on his map as the "God Knows Mountains."

P.S.—Extracts are appended of further letters that have been received from Colonel Gordon, announcing that he had decided to return from Kila Panja by the route of the Greater Pamir (so that he would be able to determine the moot point of the altitude of Wood's Lake), and also that he had made arrangements for the examination of the passes leading from the valley of the Panja into Yassin and Chitral respectively.

*Extract from a Letter of Colonel GORDON to MR. AITCHISON.*

" DEAR MR. AITCHISON,                    "Kila Panja, Wakhan, 24th April, 1874.

" The guide sepoy with the two Wakhis whom I sent up to Wood's Lake to report on the practicability of the Great Pamir road for our party at present, returned on the 22nd with favourable intelligence, and we accordingly take that route on the way back to Sirikul. Captain Trotter and Dr. Stoliczka accompany me

over the Great Pamir, while Captain Biddulph, with Resaldar Mahomed Afzul Khan, proceed by the Little Pamir (the road we came) in order to visit the Baraghil, Ish-Kaman and Durkut passes leading into Chitral, Mustuch and Yassin. The two first are open throughout the year, except for a few weeks a little later than this, when the great melting of snow takes place and the streams become flooded. The latter is closed for horse-traffic six months in the year from snow. The two former are the important ones. The Meer here has undertaken to send men with them to show the roads and passes and look after them. He owns the country right up to the summit of the passes, and has summer villages (*yelaks*) at them, where the people of Sarhadd and Baba Zungi resort to for pasture in the warm months. The Baraghil and Ish-Kaman passes are only half a day's journey from the Sarhadd villages. The visit to the passes will be carefully managed. There have been several falls of snow here since I last wrote, but the weather promises now to remain clear, and I think there is every prospect of our journey back by Wood's Lake being a successful one. Mir Futteh Ali Shah is doing everything for furnishing supplies right over to Tashkurgan, and his treatment of us throughout has been remarkably good.

" 25th April.

"All is ready for our start to-morrow, and everything promises well for our return journey to Sirikul and Tashkurgan. I have written to Hussun Shah, the Toksabai at Sirikul, regarding our further journey towards Yarkand by the direct road to Kargalik, instead of retracing our steps in the Yengi Hissar direction by the way we came. In my last I wrote that to reach the Baraghil Pass from the Great Pamir, it is necessary to pass this way, and then up by a bad bit of road to Sarhadd. I now find that I was wrong. There is a good road-track from the Great Pamir to the Little Pamir, joining the latter 10 miles below the Lake; and, moreover, there is another cross-road (not so good, however) from the Great Pamir to Sarhadd. But none of the roads in question are fit for the purposes of an army moving with anything heavier than 'mountain artillery' (mule batteries).

" T. E. GORDON."

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The following letter from Mr. T. D. Forsyth was received after the preceding were read :—

" DEAR SIR BARTLE FRERE,

" Yengi Hissar, 10th April, 1874.

" I sent you a letter from Shahidulla, in October last, giving an account of our journey across the Karakorum, which I hope

reached you. Since then Captain Trotter has, I believe, sent you some account of our travels in Kashgar territory. During the severe winter months travelling about was anything but pleasant. However, we were able to make one or two excursions. Of the visit to Chadyr-kul, on the Russian frontier, you have probably received an account. In February I made an expedition into the hills north of Kashgar, in the direction of Oosh Turfan, and was absent about a fortnight, living amongst the Kirghiz in their tents. The cold was intense, and snow fell heavily, so as to interfere greatly with Captain Trotter's observations. However, we got a tolerably correct notion of the geography of the country and mountain-ranges. The mountain-chain which girdles Kashgar territory has been at times laid exceedingly plain before us, and we have had a glorious panoramic view extending from Taghanna in Sirikol to the peaks which look down upon Oosh Turfan. Circumstances have interfered with the execution of my project to explore the north-east country as far as Lob: but, though this is personally a great disappointment, I am glad to think that by yielding now to considerations of prudence, I am far from sacrificing the interests of science; for when these people become more accustomed to see Europeans travel without any political object, they will render future explorers greater facilities than even we enjoy. But we have collected a large amount of information from Toorkee books and from the people of the country, which enables us to form a tolerably accurate idea of the north-east portion of Ameer Yakooob Khan's dominions. Our desire to visit Lake Lob has been considerably lessened by the discovery that it is only a series of marshy swamps, with here and there a stream running through it, and is evidently only a large edition of swamps which we have seen in many parts of this country. The most interesting objects in that direction are the moving sands of Gobi and the buried cities. But I have discovered that it is not necessary to travel so far east for this purpose. As we were approaching Kashgar from Yarkand, last year, I was told that a distance of about 40 miles north-east of Yengi Hissar, and in the Great Desert or 'Küm,' there was an ancient city buried. Further inquiry only added to my curiosity, and, on coming again to Yengi Hissar, I determined to visit the spot. Dr. Bellew and I were the explorers on this occasion. Leaving Yengi Hissar on the 1st April, we rode for about 12 miles through well-cultivated land, over which farmsteads are dotted about, giving a very homelike appearance to the scene. As yet spring had not actually burst, but the poplar-trees were shooting forth their blossoms, and the willows looked ready to take advantage of the first

hot day. These are the two staple trees of the country, and, with the exception of fruit-trees of all kinds, including walnuts, we have seen no other timber. There is a tree resembling the elm somewhat, but Dr. Stoliczka classes it with the poplar tribe.

"As soon as we left the village we plunged into a vast desert, with sandy hills and undulations. The water at once became brackish and scarce, and at a distance of six or eight miles a well might be seen, covered over with a little hut, in which lived the usual fakeer who supplied pilgrims and preserved the well from being filled by sandstorms. At one spot we came to a tomb by the side of a well, and the fakeer or rather the servant of the shrine offered us a loaf of bread on a wooden platter and a cup of tea, his usual gift to all passers-by. Passing this place we rode on for another 10 miles, and came upon the shrine of Huzrut Begum, a lady regarding whose identity there is considerable doubt, some saying she was a daughter of the Padshah of Rum, but she died in the ninth century. The shrine is nothing more than a mound of sand with a forest of sticks, bearing the usual votive flag of pilgrims planted on the top; but immediately adjoining it is a regular hospice. You enter by a curious gate a large enclosure, in which are rooms, after the manner of ordinary serais, for man and beast. Passing through another gateway you come to an inner courtyard, on the west of which is the mosque, at one corner of which a poplar of enormous size is propped up by walls and poles. Its appearance seems to vouch for the truth of the stories we were told of the age of the institution. Very comfortable rooms, for the higher class of pilgrims who visit the shrine, are ranged round three sides, and in one room is the holy well, containing what they called drinkable water, but it was fearfully salt. But I ought not to have taken you so far into this hospice without introducing you to the Shaikh who has the charge, and is the abbot, as it were, of this and the other hospice which I shall presently describe. Shah Mukrood, Shaikh of the Oordum Padshah and Huzrut Begum shrines, is an old man of about 87 years. He has never been beyond the nearest village in his life, and I fancy I am safe in asserting that he never tasted a drop of sweet water. Yet he is hale and hearty, has a most jovial abbot-like countenance and manner, has perfect eyesight, and rode his 18 miles across from one shrine to the other as briskly as any of us. I hope his green old age is not to be attributed to the virtues of salt-water, for length of life would be dearly purchased at the price of being compelled to drink it. Shah Mukrood gave us much interesting information, for many a wave of insurrection and revolution had flowed over the land in his time; and, doubtless, as each con-

queror or usurper came to this celebrated shrine to invoke a blessing on his arms, this old Shaikh welcomed each one in as glowing terms of praise and flattery as he bestows on the name of the present Ameer. He evidently has nothing to fear from the storms of human strife. His danger comes from the sea of sand which he has watched advancing on him for the last eighty years, and seen it overwhelm and obliterate building after building.

"The story of Oordum Padshah, briefly told, is this:—When Sabik Boghra Khan, King of Kashgar, turned Mahomedan in about A.D. 970, his zeal for the new faith led him to make war on all his neighbours. His son, Aralau Khan, regarding whose birth a miraculous story borrowed from our New Testament is told, attacked and destroyed many of the forts and towns in this direction, but was finally overcome and destroyed with his whole army at Oordum Padshah. It was then a flourishing country, so the story goes. Aralau Khan's brother came too late to save his life; but he pursued his enemies as far as Kagyar, and defeated them, after which he returned to give honourable burial to his brother and the martyrs to the faith. But when he reached the spot he found what he had left a flourishing country had been suddenly turned into a wilderness of sand, and the bodies of these 'Shahuds' had been entombed by the elements. A city which he had sacked, as he had passed by to Kagyar, had likewise disappeared from view. This was about 800 years ago; and I fancy, from that day to this, no one had cared to visit its ruins. The old Shaikh had vague notions of its existence; but he said he could point out the direction. We lost no time in going off towards it, with English spade and pickaxe, to see what we could find. There was a slight elevation in one part of the desert, which seemed to indicate the site, and, on closer examination, we found what perhaps might be the ruins of two towers. The ground was slightly strewed with pieces of old pottery, and there was no doubt about habitations having existed there at some time or other. We were not very successful in our excavations; but I collected a quantity of little bits of *glass*, glazed pottery, and found two coins, one of which has a tolerably legible inscription, but in characters unknown to anyone here. This coin will, no doubt, be deciphered in course of time and may throw some light on the subject. The glass is a very curious feature. No glass is now in use in this country; but, from the shape and appearance of the bits I have found, it is evident that, 800 years ago, glass cups and vessels were in use. Most probably they had been brought from China. As all the buildings in the country are, and apparently always have been, of mud, and stone or burnt-brick edifices are exceedingly rare, it is

not surprising that the traces of any town should become obliterated.

"From Huzrat Begum we rode for 18 miles across the desert to Oordum Padshah, and found on our way quite a different appearance to that which presented itself at Huzrat Begum. After crossing a long low ridge we came upon the veritable 'kum,' or great moving sand. As we looked upon it from the height the appearance was that of the sea in a violent gale, where billows upon billows rise mountains high, all flowing in the same direction. These sand-billows were often 100 feet high, all in the same course from north-west to south-east, and, sloping up from the north-west side to their crest, fell precipitably on the south-east side. Between these billows the original soil of the desert, with here and there some shrubs and reeds, was to be seen. Old Shah Mukrood told us how these sandy waves had gradually advanced in his day. We passed a 'Sungur,' or hospice, half-buried in the sand. He told us that it had been built a century ago, and he remembers the time when it stood out on the plain, free from all apparent danger. Thirty years ago the advancing sand-wave warned the inmates to seek a safer abode. When we passed it the building had all the appearance of having been abandoned yesterday, so fresh and sharp were the lines of the walls and arches. But desolation and destruction are not far off. Just behind it and touching its walls a hillock of sand, full 100 feet high, hung over it, from the crest of which sand seemed to have rained down into the courtyard, and in course of time the whole will be completely buried. We came to another such spot, where the Shaikh informed us a hospice was buried, which he himself had built. There is no trace of it now left. These sand-hills are distinctly separate from the soil they overwhelm: it is an interesting question where they came from. From their appearance, as well as from the testimony of the Shaikh and others, they advance in one direction from north-west, and with such regularity, that the Shaikh said any buildings erected on one side or other of the line would be perfectly safe. Moreover, the motion of this sand only takes place during two months in the year—April and May—whereas in other parts of the desert portion sand and dust are blown about at all times. The Desert of Gobi (Gobi, by-the-by, means 'great,' and is a Toorkee word) lies to the east of this; so that if these sands came thence they must be borne first west till they are stopped by the Thian Shan range, and then swept round by the eddying current to a south-east direction. But I cannot venture at present to form any theories, and merely record the facts, which perhaps you may think interesting.

"At Aralau's shrine the present Ameer has erected a very fine hospice, with mosque and rooms for travelling devotees. It is at present in an open plain; but I dare say some future explorer of Central Asia will have to search in vain amongst the sandy billows for a trace of its existence.

"I am glad to think that if no other result to geographical knowledge be attained, this Mission will have the honour of unfolding to the world the mysteries of the Pamir. The question of our return by Cabul is not yet decided; but the chances are all against it, so that I am glad I have secured this exploration, and I have given instructions to Captain Trotter to take advantage of every opportunity to gain information. Colonel Gordon, Captain Biddulph, and Dr. Stoliczka, who are also of the party, will make good use of their eyes, ears, and hands. I find that the word Pamir, or Pamîr, is applied in Toorkee to waste tracts of land, and this undoubtedly is what is understood when speaking of that part of the country which we know as Pamir.

"I will not, however, lengthen this letter by going into the description of Sirikol and the country to the south; but on the return of my exploring party shall hope to offer information which perhaps may be interesting.

"I am exceedingly sorry that I cannot add Khoten to the list of places actually visited; but my inability to go there arises from no want of desire or pressing on my part. In Central Asia one is not a perfectly free agent; and I may propose, but Ameer Yakoob Khan disposes.

"I am yours very truly,

"The Right Honourable

"T. D. FORSYTH.

"Sir Bartle Frere, G.C.S.I., &c."

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## ADDITIONAL NOTICES.

(Printed by order of Council.)

1.—*Report to the Council on the Arrangements for the Funeral of Dr. Livingstone.*

1, Savile Row, Burlington Gardens,

GENTLEMEN,

April 24th, 1874.

In accordance with the Minute of Council, giving power to the President to make such arrangements, on behalf of the Society, as he might see fit for the reception and interment of the body of Dr. Livingstone, Sir Bartle nominated Colonel J. A. Grant and James Fergusson, Esq. (assisted by Mr. H. W. Bates, the Assistant-Secretary), to act for the Council in the matter; and on Mr. Fergusson afterwards wishing to retire, General Rigby was nominated to officiate in his stead.

An answer to the application made by Sir Bartle Frere to Her Majesty's Government, to defray the expenses of the funeral, was received in the afternoon of the 10th of April in the following letter :—

“ MY DEAR SIR BARTLE,—

“ 11, Downing Street, Whitehall,  
“ April 10, 1864.

“ I have been in communication with Mr. Disraeli, who, as you know, is out of town, on the subject of the funeral of Dr. Livingstone. The Government, being desirous to show their respect for his memory, have taken upon themselves the charge of bringing his remains to this country, and are further willing to bear the necessary expenses attending their interment. They do not, however, purpose to take upon themselves the arrangements of the funeral, which they think should be left to the family or friends of the deceased; and they consider that the most convenient course for them to adopt will be to make a grant of a fixed sum (250*l.*), to be applied in such manner as the friends think best.

“ Understanding that the Royal Geographical Society have interested themselves in the matter, I shall feel obliged by your informing me whether they will take charge of the arrangements. In that case the sum I have named shall be placed at their disposal.

“ I remain

“ Yours very faithfully,  
(Signed) “ STAFFORD H. NORTHCOTE.

“ The Right Hon. Sir H. Bartle Frere, K.C.B.”

Sir Bartle having accepted the charge of the arrangements in the name of the Society, the Committee, consisting of Mr. W. F.  
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Webb (of Newstead Abbey), acting (together with Sir Bartle Frere) with full powers on behalf of the family, the Rev. Horace Waller (also on behalf of the family and friends), and General C. P. Rigby, and Colonel J. A. Grant, c.b., assisted by Mr. Bates, were called together. The formal consent of the Dean of Westminster to the interment of the body in the Abbey had been received some days previously; and it was now arranged that Mr. Banting's estimate for the funeral should be accepted; that General Rigby and Colonel Grant should proceed to Southampton, to receive the body on behalf of the Council, and, in accordance with the directions of the Foreign Office, that it should lie in the rooms of the Society pending the arrangements of the funeral in London, and that Mr. Webb should invite Sir William Fergusson, the eminent surgeon, to examine and identify the body on its arrival.

The following Report renders an account of the proceedings of the Council Delegates in Southampton.

1, Savile Row, Burlington Gardens, W.

SIR,

April 24th, 1874.

I have the honour to report for the information of the Council that Colonel Grant, c.b., and myself proceeded to Southampton on the 12th inst., in order to receive charge, on behalf of the Council, of the remains of the late Dr. Livingstone, which were expected to arrive per P. & O. Company's steamer *Malwa* on the following day.

We reported our arrival to the Mayor of Southampton, and that gentleman treated us, and the other members of our Committee, with the greatest attention and hospitality. His Worship had engaged ten rooms for our accommodation at the South-Western Hotel, and insisted on considering us as his guests during our stay.

Vice-Admiral Sir W. Hall, who was deputed to represent the P. & O. Company on the occasion, also liberally provided us with steamers, both to meet the *Malwa* and to land the remains, and the Company would make no charge.

The South-Western Railway Company also provided a special train, free of charge, for the conveyance of the body and cortège to London.

The Mayor and Corporation attended in their robes, and received the body with the utmost solemnity, and the town was thronged by a vast assemblage of people, who showed marked respect to the funeral procession.

We feel deeply indebted to the Worshipful the Mayor for his great hospitality and sympathy, and to the Corporation of Southampton for the admirable arrangements they made.

C. P. RIGBY.

The body arrived in London at a little after 3 P.M. on Wednesday the 15th, and the surgical examination was performed on the same day in the Council Room, between the hours of 5 and 7; there being present, besides Sir William Fergusson and his two assistants, Dr. J. Kirk and Dr. Loudon (the family surgeon from Hamilton, in Lanarkshire.)

The following report of the examination, by Sir William Fergusson, is extracted from '*The Lancet*' of April 18, 1874:—

"EXAMINATION AND VERIFICATION OF THE BODY OF THE LATE  
DR. LIVINGSTONE.

"*To the Editor of "The Lancet."*

"SIR,—For many years there has probably been no single individual on whom a greater amount of interest has been concentrated throughout the world than Livingstone. Naturally the excitement has been greatest in Britain. In America it has perhaps been all but equal; and wherever British interests extend, the doings, and latterly the fate, of this remarkable man have thrilled alike on the hearts and tongues of all who prize some of the most marked features of modern civilisation. Giving every credit to our great philanthropists, to our Houses of Lords and Commons, no single human being has struck more deeply at the roots of all that remained in modern times of the curse of slavery than this simple-minded, noble-hearted missionary, who has served God and man with such force, power, and enduring energy, as have never perhaps been exceeded by any other human being.

"It is not in the province of such a journal as yours to comment specially on such themes, and much less is it in mine to refer specially to them in your pages. I cannot, however, but remind you that Livingstone, besides his holy occupation, belonged to our profession. In my own mind I have a strong impression that a considerable portion of his great works resulted from that part of the education which he imbibed in our professional schools, and I therefore look with pride to the fact that his name must ever be enrolled as one of the most remarkable men in our ranks.

"Many doubts have attended the movements of our great explorer in his latter years, which will probably be soon cleared up, as his papers become collected and collated. And within the last few months many have hesitated to believe that he was dead. Above all, it seemed beyond ordinary probability that his remains would have been brought from Central Africa to our heart of London. That a body was on its way from this all but mythical region could hardly be doubted after the examination at Zanzibar of the remains; but many were sceptical as to this dead frame being that of Livingstone. Up to within a few days, I may say until between five and six o'clock this afternoon, even the closest believers in his story felt in the position that they could not affirm more than was the general rumour.

"Happily, it was borne in mind by many old friends that he had one condition of body which would mark the identification of his remains even if years and years had elapsed. The skeleton of the human frame being the last part which decays and falls into impalpable dust, it was thought by those who knew some part of his physical condition that if it should be proved, on anatomical examination, the remains of an old ununited fracture in his left humerus (arm bone) could be recognised, all doubt on the subject would be settled at once and for ever.

"It has fallen to my lot to have the honour of being selected to make the crucial examination to this end, and I have accordingly performed that duty.

From what I have seen I am much impressed with the ingenious manner in which those who have contrived to secure that the body should be carried through the long distance from where Livingstone died until it could reach a place where transit was comparatively easy, accomplished their task. The lower limbs were so severed from the trunk that the length of the bulk of package was reduced to a little over four feet. The soft tissues seem to have been removed to a great extent from the bones, and these latter were so disposed that by doubling and otherwise the shortening was accomplished. The abdominal viscera were absent, and so were those of the chest, including, of course, heart and lungs. There had been made a large opening in front of the abdomen, and through that the native operators had ingeniously contrived to remove the contents of the chest, as well as of the abdomen. The skin over chest, sternum, and ribs had been untouched.

" Before these points were clearly ascertained, some coarse tapes had to be loosened, which set free some rough linen material—a striped coloured bit of cotton cloth, such as might have been an attractive material for the natives, among whom Livingstone travelled—a coarse cotton shirt, which doubtless belonged to the traveller's scanty wardrobe, and in particular a large portion of the bark of a tree, which had formed the principal part of the package—the case thereof, no doubt. The skin of the trunk, from the pelvis to the crown of the head, had been untouched. Everywhere was that shrivelling, which might have been expected after salting, baking in the sun, and eleven months of time. The features of the face could not be recognised. The hair on the scalp was plentiful, and much longer than he wore it when last in England. A moustache could not be recognised, but whiskers were in abundance. The forehead was in shape such as we are familiar with from memory, and from the pictures and busts now extant. The circumference of the cranium, from the occiput to the brow, was 23 $\frac{1}{4}$  inches, which was recognised by some present to be in accordance with such measurements when alive.

" In particular the arms attracted attention. They lay as if placed in ordinary fashion, each down by the side. The skin and tissues under were on each side shrunk almost to skeleton bulk, and at a glance to practised eyes—there were five, I may say six, professional men present—the state of the left arm was such as to convince everyone present who had examined it during life, that the limb was Livingstone's. Exactly in the region of the attachment of the deltoid to the humerus, there were the indications of an oblique fracture. On moving the arm there were the indications of the ununited fracture. A closer investigation and dissection displayed the false joint which had long ago been so well recognised by those who had examined the arm in former days. The Rev. Dr. Moffat, and in particular, Dr. Kirk, late of Zanzibar, and Dr. Loudon, of Hamilton, in Scotland, at once recognised the condition. Having myself been consulted regarding the state of the limb when Livingstone was last in London, I was convinced that the remains of the great traveller lay before us. Thousands of heads with a like large circumference might have been under similar scrutiny; the skeletons of hundreds of thousands might have been so; the humerus in each might have been perfect; if one or both had been broken during life it would have united again in such a manner that a tyro could easily have detected the peculiarity. The condition of ununited fracture in this locality is exceedingly rare. I say this from my personal professional experience, and that such a specimen should have turned up in London from the centre of Africa, excepting in the body of Dr. Livingstone, where it was known by competent authorities to have existed, is beyond human credibility. It must not be supposed by those who are not professionally acquainted with this kind of lesion—which often causes so much interest to the practical surgeon—that a fracture and new joint of the kind now referred to could have been of recent date, or made for a purpose. There were in reality all the indi-

cations which the experienced pathologist recognises as infallible, such as the attenuated condition of the two great fragments (common under such circumstances), and the semblance of a new joint, but actually there was a small fragment detached from the others which bore out Livingstone's own view that the bones had been 'crunched into splinters.' Having had ample opportunity of examining the arm during life, and conversing with Livingstone on the subject, and being one of those who entertained hopes that the last reports of Livingstone's death might, like others, prove false, I approached the examination with an anxious feeling regarding this great and most peculiar crucial test. The first glance at the left arm set my mind at rest, and that, with the further examination, made me as positive as to the identity of these remains as that there has been among us in modern times one of the greatest men of the human race—David Livingstone.

"The accompanying extract from Dr. Livingstone's 'Missionary Travels and Researches in South Africa,'\* published in 1857, will be read with peculiar interest at the present date. It bears specially upon the matter now in question. The physiology referred to has, I know, attracted special attention from the late Sir Benjamin Brodie and others, and the pathos of his statement of how he meant to have kept the tale of the occurrence 'in store to tell my grandchildren when in my dotage,' must touch the heart of all who have sympathy with the life-story of this modern hero.

"WM. FERGUSSON.

"George-street, Hanover-square, April 15th, 1874."

The Dean of Westminster having fixed Saturday the 18th as the day of the interment, the Committee had but two days within which to make all necessary arrangements—the invitation of mourners and representatives of public bodies, and the distribution of tickets for the Abbey to Fellows of the Society and the public. The Dean placed 900 reserved places at the service of the Committee, tickets for which were furnished to them by the undertaker. To aid in the selection of persons to be invited to the funeral, and the distribution of the tickets, the Committee added to their number Mr. E. Hutchinson, Secretary to the Church Missionary Society, and Dr. Birdwood, of the India Office. Meantime, the coffin was placed in the Map-Room of the Society, and visited during Thursday and Friday, the 16th and 17th, by a large number of the Fellows and the public.

The Committee had, at first, the intention of limiting the cost of the funeral to the amount of the Government grant, viz. 250*l.*, and they directed Messrs. Banting accordingly to provide nothing but what was strictly necessary; and prepare for five mourning carriages only, which was all the means at their disposal would admit of. The necessity, however, for providing places in the funeral cortège for the numerous representatives of municipal, scientific, and religious bodies, who requested to be allowed to take part in the ceremony, became so urgent that they were obliged gradually to increase the number of mourning carriages to twelve. Several un-

\* Relating to his encounter with the lion.

foreseen items of expense also presented themselves, such as a new and suitable coffin, &c., which tended to augment the total cost of the funeral to 500*l.* 19*s.* 1*d.*, viz., Messrs. Banting's bill, 487*l.* 6*s.* 10*d.*, and cost of postages, telegrams, &c., 13*l.* 12*s.* 3*d.*

As already stated in General Rigby's Report of the Proceedings at Southampton, no expenses were incurred at that place on account of the reception of the body, and the London and South-Western Railway Company made no charge for the conveyance of the same to London.

The following is a list of the mourners at the funeral :—

First coach.—Mr. T. S. Livingstone and Mr. W. Oswell Livingstone (sons), Dr. Moffat, Mr. James Vavasseur (relatives). 2nd coach.—Sir T. Steele, Dr. Kirk, Mr. W. F. Webb, Jacob Wainwright (pall bearers); African boy Kalulu in this carriage. 3rd coach.—Rev. Horace Waller, Mr. Oswell, Mr. E. Young, Mr. H. M. Stanley (pall bearers). 4th coach.—Sir. W. Fergusson, Rev. H. W. Hamilton, Dr. J. Loudon, and Mr. James Hannan. 5th coach.—The Duke of Sutherland, The Right Hon. Sir Bartle Frere, K.C.B. (President Royal Geographical Society), Sir H. C. Rawlinson, K.C.B. (Vice-President Royal Geographical Society), and Mr. Kenneth R. Murchison. 6th coach.—General Rigby, Colonel J. A. Grant, C.B.; Mr. J. Murray, and Mr. J. Young, jun. (of Kelly). 7th coach.—Vice-Admiral Baron de la Roncière le Noury (President French Geographical Society), Dr. Hooker (President Royal Society), Lord Houghton, Mr. H. W. Bates (Assistant-Secretary Royal Geographical Society). 8th coach.—The Provost of Hamilton, Mr. J. B. Braithwaite, Mr. C. R. Markham, and Mr. R. H. Major (Secretaries Royal Geographical Society). 9th coach.—Rev. Dr. Stewart, Mr. T. Nicholson, Mr. Ralston, Mr. J. Young, of Kelly (friends of the family). 10th coach.—The Lord Provost of Edinburgh, Mr. Duncan McLaren, M.P.; Mr. James Cowan, M.P.; Mr. Josiah Livingstone. 11th coach.—The Lord Provost of Glasgow, Dr. Watson (President, Faculty of Physicians, Glasgow), Baillie Walls (Chief Magistrate, Glasgow), Baillie Bain. 12th coach.—Mr. Edwin Jones (Mayor of Southampton), Sir Frederick Perkins, Mr. A. Laing (in charge of the body from Zanzibar).

C. P. RIGBY.

J. A. GRANT.

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Since the above Report was received and accepted by the Council, Her Majesty's Government have communicated to the President their intention of defraying the whole cost of the funeral.

*2.—Memorial to the Universities of Oxford and Cambridge.*

BEFORE the close of the Session the following Memorial was addressed by the President, under the authority of the Council, to the Universities of Oxford and Cambridge :—

TO THE VICE-CHANCELLOR OF THE UNIVERSITY OF OXFORD.

SIR,

I am requested by the Council of the Royal Geographical Society to submit for your own consideration, and for that of the Hebdomadal Council, the claim of Geographical Science to due recognition in any future redistribution of Academical revenues.

The Council of the Royal Geographical Society have observed with much satisfaction that a definite place has been assigned to Geography in the new scheme for the examination of schools by the Universities. In making their present application, they are aware that it would be premature to expect any decisive reply until the Commission appointed to investigate Academical revenues shall have made its report, and action shall be taken thereupon, either by the Government or by the Universities themselves. The Council are also aware that a great part of Academical revenue is derived from College endowments, which are not strictly at the disposal of the Universities. Nevertheless, they entertain the conviction that no plan for dealing with College endowments is likely to be adopted by the Legislature without having been previously laid before the Universities, whose recommendations on this subject must needs carry the greatest weight and authority.

I am, therefore, requested to represent that, in the opinion of the Council of the Royal Geographical Society, it would be highly expedient to establish a Professorship of Geography in the University of Oxford, and, moreover, to found Geographical Fellowships, side by side with the existing Radcliffe Travelling Fellowships which, as they understand, are applied to the promotion of Medical as distinct from Geographical Science.

In support of this proposal, I would venture to remark that, since the results of all the natural sciences are co-ordinate in Physical Geography, that study would appear to be eminently suitable for professorial research and teaching in Universities, which are already rich in representatives of these sciences. It would not tend in any degree to supersede the special cultivation of any independent science, but would rather intensify the interest now felt in each of them, by showing their general value in scientific education, and by

establishing connections between them which might otherwise be unobserved. I may add that Physical Geography has the advantage of being well adapted to lectures before mixed audiences, because many of its results are so broad and popular as to reach the understanding and imagination even of those who have little scientific knowledge.

I would further point out that, while the facilities for travelling are so vastly extended, and while the number of young men who travel after leaving the University, for the sake of supplementing their education, is increasing every year, very few of them are qualified to make an intelligent use of the information which they may or might obtain, and fewer still are qualified to make observations of the least scientific value. The same may be said, with little variation, of the much smaller number who go out as missionaries, and who often enjoy precious opportunities of collecting new evidence, not merely on Geographical questions, but on questions of Ethnological and Philological interest. Such persons, if previously trained under an able Professor at an University, would be among the most valuable correspondents of this and other scientific bodies.

The institution of University Fellowships, on the principle of those founded under Dr. Radcliffe's will in the University of Oxford, but for the direct encouragement of Geographical Science, would seem to be an appropriate and effective mode of directing the spirit of adventure, so common among young travellers, into an useful channel. If this view should be adopted by the University of Oxford, I would suggest, on behalf of the Council of the Royal Geographical Society, that one of such Fellowships thus set apart might with propriety be called "Livingstone Fellowship," in memory of the great traveller who combined in himself the character of Missionary, Geographer, and Scientific Observer, and whose example might be thereby kept before the eyes of English youths for generations to come.

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\* \* \* The memorial to the Vice-Chancellor of Cambridge varied from the above in certain minor points relating to the different circumstances of the University.

3.—*Circular and Programme of the Congrès International des Sciences Géographiques, to meet in Paris in the Spring of 1875.*

(CIRCULAR.)

“LA connaissance de notre habitation terrestre est,” comme l'a dit un de nos géographes les plus distingués,\* “la science à laquelle nous nous rattachons par les liens les plus intimes : peu de sujets touchent à de si nombreux et à de si grands intérêts.”

Comme toutes les autres sciences cependant, la Géographie a été longtemps le domaine exclusif de quelques rares adeptes. C'est seulement lorsque l'esprit de recherche scientifique s'est répandu dans le monde, qu'elle a aussi participé au courant qui entraînait le genre humain vers l'étude. Les gouvernements ont favorisé ses progrès ; puis des associations libres se sont formées successivement sur des points divers pour donner aux travaux géographiques une plus vive impulsion. A peine créées, ces Sociétés ont senti le besoin de coordonner leurs œuvres séparées, d'abord en établissant des correspondances régulières ; plus tard, la facilité des communications aidant, en appelant à une commune discussion tous les hommes qui s'étaient occupés isolément de si graves problèmes.

De cette pensée est né le Congrès tenu en 1871 à Anvers, et si le grand et légitime succès de cette fête de la science est dû en majeure partie au zèle habile d'éminents organisateurs et au concours empressé de nombreux adhérents, comment ne pas l'attribuer aussi à l'intérêt exceptionnel que présente une science dont le domaine, à peine limité, est exploité partiellement par beaucoup d'autres, et peut servir de terrain commun à des recherches si variées ?

C'est cette voie, déjà ouverte, que la Société de Géographie de Paris veut suivre à son tour, encouragée dans cette tâche par ceux mêmes qui l'avaient commencée. Forte de l'appui du Maréchal Président de la République, et espérant obtenir l'adhésion des gouvernements étrangers, elle a décidé qu'ux nouveau Congrès des sciences géographiques sera convoqué à Paris, au printemps de l'année 1875.

Etudier la terre dans ses aspects divers, dans sa constitution physique, dans les manifestations de la vie à sa surface ; examiner les moyens de la mesurer et de la représenter, et déterminer ses rapports avec les corps célestes ; rétablir les états successifs de notre planète aux différentes époques, et retrouver sur le sol les empreintes de l'histoire reconstituée par l'érudition moderne ; chercher à rendre plus promptes et plus faciles les relations entre les peuples et à livrer par degrés à l'homme toute la surface habitable ; comparer entre elles les méthodes d'enseignement et unifier les efforts pour la diffusion et le progrès de la science ; s'entendre sur les explorations à entreprendre et sur la manière de mettre, pour les accomplir, les forces humaines à même de triompher de tous les obstacles ; en un mot, constater ce qui est certain, discuter ce qui est douteux, découvrir ce qui est inconnu dans l'étude théorique et pratique de la terre, tel est le but du Congrès de Paris.

Nous faisons donc appel aux Géographes qui s'appliquent spécialement à cet ordre d'études ; aux savants qui dans d'autres recherches empruntent quelquefois le secours de la Géographie ; aux voyageurs qui, au péril même de leur vie, on le sait, ont élargi les horizons de la science et multiplié les routes du commerce ; aux professeurs qui, par leurs enseignements ou leurs écrits, ont contribué à répandre les connaissances géographiques ; aux ingénieurs qui, par leurs admirables travaux, ont créé des communications dans le monde entier ; à tous ceux enfin, et le nombre en est grand, qui portent à toutes ces questions un puissant intérêt, et qui croient utile de propager de plus en plus une science éminemment nécessaire.

\* Vivien de Saint-Martin, ‘Histoire de la Géographie.’

Nous convions à ces assises pacifiques les hommes de bonne volonté de tous les pays, certains qu'ils n'y apporteront d'autre passion que celle de la vérité. Nous demanderons plus particulièrement le concours des Sociétés scientifiques étrangères, et nous les prierons d'envoyer des délégués, de désigner les personnes auxquelles des convocations devront être adressées, de signaler les questions qui pourront être avantagéusement posées.

Le Congrès sera accompagné d'une Exposition des objets ayant trait à l'étude de la Géographie. Des récompenses seront décernées aux plus méritants parmi les exposants.

C'est là, dans son ensemble, le programme des mesures que prendra la Société de Géographie pour donner à la solennité tout l'éclat qu'elle comporte. Confiant dans l'utilité de son entreprise, soutenue par de hauts patrons et de nombreuses adhésions, la Société se consacrera avec sollicitude et persévérance à cette œuvre de lumière et de paix. Il appartient à tous de rendre notre tentative durable et féconde par une propagande active, par un concours dévoué, par une attention soutenue. Ils seront comme nous bien récompensés, si nos efforts réunis réussissent à faire avancer l'humanité d'un pas de plus dans la voie du progrès, et si, imitateurs aujourd'hui, nous pouvons à notre tour servir de modèles à ceux qui nous suivront, contribuant ainsi à fonder une ère périodique de Congrès internationaux tenus successivement dans chaque pays, où les hommes de savoir et d'intelligence éclaireront le passé et prépareront l'avenir des sciences géographiques.

*Le Président de la Société de Géographie,*

Vice-Amiral Baron de LA RONCIÈRE LE NOURY.

*Le Président de la Commission centrale,*

DELESSE,

Ingenieur en chef des Mines.

*Le Secrétaire général de la Société Géographie,*

*Le Commissaire général du Congrès,*

MAUNOIR.

Baron R. REILLE.

Paris, le 28 Mars 1874.

#### *List of Subjects for Discussion to be submitted to the Congress.*

##### I. GROUPE MATHÉMATIQUE.—*Géographie Mathématique—Géodésie—Topographie.*

1. Substitution de la division centésimale du quart de la circonférence, à la division dite sexagésimale. Conséquences relatives à la division du temps en astronomie.
2. Choix d'un zéro pour un niveling général.
3. Instruments de précision les plus récents ; chronomètres ; appareils enregistreurs ; planchette photographique.
4. Mesure des différences de longitudes. Utilisation des lignes télégraphiques au point de vue de la détermination des longitudes. Progrès apportés à la géographie par la télégraphie électrique. Emploi des chronomètres.
5. Mesure d'un arc de méridien dans l'hémisphère sud et en particulier dans la République Argentine.
6. Études des courbures générales ou locales de l'écorce terrestre.
7. Étude synthétique des faits d'alignement naturels. Observations qui peuvent mettre en évidence des faits d'alignement, en dehors de celles qui se poursuivent déjà sur les chaînes de montagnes, les sillons et les contours hydrographiques. Réseau pentagonal. Applications de ces études.

8. Attractions locales. Comparaison des résultats entachés de leur influence et des résultats fournis par la géodésie.
  9. Étude de la variation de la pesanteur à l'aide du pendule. Choix des points où il serait le plus utile de faire de nouvelles observations.
  10. Instruments les plus simples, méthodes les plus rapides pour déterminer la déclinaison magnétique.
  11. Publication des cartes donnant les courbes de déclinaison magnétique.
  12. Perfectionnements apportés aux méthodes de levés topographiques.—Applications de la photographie.
  13. Canevas des cartes géographiques. Projections et constructions diverses. Choix raisonné du système à appliquer. Comparaison des canevas adoptés pour les cartes des grands États. Possibilité d'unifier les travaux cartographiques des divers services. Cartes hypsométriques.
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## II. GROUPE HYDROGRAPHIQUE.—*Hydrographie—Géographie Maritime.*

14. Choix d'un système simple et uniforme pour compter les rumbus de vent.
  15. Progrès récents apportés par l'étude du régime des vents dans la question des itinéraires maritimes.
  16. Recherches de la profondeur à laquelle se propage l'agitation de la surface de la mer.
  17. Études des marées; lois générales; anomalies. Choix des lieux les plus propres à l'observation de ces phénomènes.
  18. Études des ras de marée et de leurs causes. Phénomènes analogues dans les grands lacs.
  19. Études des courants marins. Question des courants dans les détroits.
  20. Propagation de la marée dans les rivières.
  21. Progrès récents de l'étude du régime des cours d'eau.
  22. Détermination de la température de la mer à différentes profondeurs. Instruments à employer. Choix des points où ces observations doivent être faites de préférence.
  23. Causes de la température du Gulf-Stream.
  24. Sondages dans les grandes profondeurs. Observations physiques et chimiques qui en sont inséparables. Instruments les plus simples; méthodes les plus pratiques.—Pose des câbles télégraphiques sous-marins.
  25. Programme d'instructions internationales relatives aux observations qui peuvent être faites utilement à bord.
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## III. GROUPE PHYSIQUE.—*Géographie Physique—Météorologie Générale—Géologie Générale—Géographie Botanique et Zoologique—Anthropologie Générale.*

26. Faits nouveaux et bien constatés relativement à la mobilité de l'écorce terrestre depuis les temps historiques.
27. Comment établir des repères qui permettent de constater cette mobilité du sol et d'en mesurer l'amplitude, quelque faible qu'elle soit, tant à l'intérieur des continents qu'au bord des mers.
28. Théories diverses relatives à l'origine des montagnes.
29. Faire ressortir les rapports qui existent entre le relief du sol et sa constitution géologique.
30. Lithologie du fond des mers.
31. Résultats actuels des nouvelles études sur les influences qu'exercent les phénomènes astronomiques, tels que : taches du soleil, chutes de météorites, &c.

32. Faire connaître les faits nouveaux relatifs à circulation de l'atmosphère et de l'Océan, aux déplacements des courants aériens et maritimes et à leur influence sur les climats.

33. Rechercher l'origine et la marche générale des grands tourbillons atmosphériques ou cyclones ainsi que leurs périodes. Préciser leur durée, leur énergie et l'étendue des pays exposés à leurs effets.

34. Moyens à employer pour donner plus d'extension à l'établissement et à la discussion des observations météorologiques simultanées, recommandées par le Congrès international de Vienne.

35. Signaler les travaux les plus récents relatifs à la distribution géographique des lignes isothermes, isochimères et isobares et à la répartition des pluies. Quel est le procédé le plus correct pour obtenir les moyennes annuelles?

36. La quantité d'eau qui tombe annuellement sur le globe a-t-elle subi des variations, soit à l'époque actuelle, soit aux époques géologiques antérieures? Quelles contrées ont présenté, de mémoire d'homme, des changements de cette nature?

37. Quelle modification le percement de l'isthme de Suez a-t-il produite sur le climat des pays environnants? Quelles seraient, d'après les études les plus récentes, l'étendue de la mer Saharienne aboutissant au golfe de Gabès et les variations de climat qu'elle produirait en Afrique et en Europe?

38. Comparer l'état météorologique ancien et actuel des pays où les forêts ont été dévastées. Préciser l'influence que les reboisements ou gazonnements des montagnes ont eue sur la quantité de pluie tombée et sur l'écoulement des eaux à la surface du sol.

39. Distributions géographiques des gîtes de combustibles minéraux, des métaux précieux et particulièrement de l'or et de l'argent.

40. Faire connaître la distribution géographique des sables, au bord de la mer et à l'intérieur des continents. Discuter leur origine, ainsi que les causes et les effets de leurs déplacements.

41. Distribution géographique des espèces animales et végétales pendant les temps tertiaires. Conséquences qui en découlent relativement à la climatologie du globe pendant cette période, et relativement à la distribution des terres et des eaux. Rapports géographiques entre les faunes et les flores tertiaires et les faunes et les flores actuelles.

42. Distribution géographique des espèces animales et végétales pendant les temps quaternaires. Conséquences qui en découlent relativement à la climatologie du globe pendant cette période. Rapports géographiques entre les faunes et flores quaternaires et les faunes et les flores actuelles. Extinctions et migrations. Distribution des terres et des eaux pendant cette période.

43. Peut-on établir, par l'étude de leur faune et de leur flore, quels sont les points du globe qui jadis étaient reliés à la Nouvelle-Zélande?

44. Influence des causes antérieures à la période géologique actuelle sur l'aire occupée à notre époque par les espèces végétales.

45. Influence du climat, de la latitude et de l'altitude sur la végétation.

46. Quelle est la part des divers agents de dispersion des graines dans la distribution géographique des espèces végétales?

47. De l'homme et des cultures envisagés comme cause de la dispersion d'un grand nombre d'espèces cosmopolites ou à très-large diffusion. Plantes accompagnant le plus généralement l'homme dans ses migrations.

48. Espèces, genres et familles de plantes qui sont caractéristiques des grandes régions naturelles.

49. Végétaux cultivés en grand dans les régions naturelles.

50. Changements produits dans les flores par le déboisement, le défrichement, le pacage et la culture.

51. Conclusions pratiques que l'on peut tirer de l'étude d'une flore et de sa

comparaison avec celle d'autres contrées au point de vue de l'agriculture ou de l'acculturation.—Indication des plantes utiles ou d'ornement, dont l'introduction peut être avantageusement tentée d'après ces données.

52. Quelles sont les causes qui font habituellement disparaître les espèces introduites par des circonstances accidentnelles dans un pays ou une station?—Quelles sont, au contraire, les conditions qui peuvent amener la permanence des espèces qui y ont été introduites accidentellement?

53. Observations et collections botaniques à faire dans les voyages.

54. Étudier les ressemblances et les dissemblances qui existent entre la population zoologique des diverses îles de la Polynésie; y a-t-il dans cette région une faune générale ou plusieurs foyers zoologiques distincts? Quelles sont les espèces indigènes et quelles sont les espèces introduites?

55. Quelles limites septentrionales doit-on assigner à la faune sud-américaine?—A quelle époque les deux parties du Nouveau Monde se sont-elles réunies l'une à l'autre, et dans quelle mesure les faunes de ces deux régions se sont-elles mélangées?

56. Les animaux de l'Amérique du Nord et de l'Asie septentrionale appartiennent-ils au même foyer zoologique?

57. Quelles sont les modifications que la faune européenne a subies durant l'époque actuelle?

58. Distribution géographique des races humaines préhistoriques et de celles qui sont regardées comme fossiles; rapports géographiques de ces races avec les races actuelles.

59. Expansion des races humaines depuis l'époque des grandes découvertes modernes; migrations, transplantations, acclimatation, substitution d'une race à une autre.

60. Distribution géographique des races humaines anciennes et actuelles de l'Océanie.—Discussion des lignes de Wallace: Malais, Papous et Négritos.—Mélanésie, Polynésie.

61. Distribution géographique des races noires africaines.—Nègres dolichocéphales, brachycéphales, Bosjesmans et races dérivées.

62. Distribution géographique des races jaunes.—Races mongoliques et mongoloïdes. Races jaunes de l'Inde et de l'Indo-Chine.

63. Distribution géographique des races américaines. Peaux-Rouges et Esquimaux blancs et rouges. Extension ancienne et actuelle de la race Guaranie.

64. Distribution géographique des races blanches. Rapports des éléments blancs et jaunes dans le centre et le sud de l'Asie. Races blanches de l'Afrique septentrionale.

65. Géographie médicale. Phthisie pulmonaire, fièvre jaune, choléra.

#### IV. GROUPE HISTORIQUE.—*Géographie Historique et Histoire de la Géographie—Ethnographie—Philologie.*

66. Constater sur le territoire de l'Europe aux temps préhistoriques, l'existence de populations diverses d'instincts, de mœurs, d'aptitudes, d'après les monuments qu'elles ont élevés, les ustensiles et les œuvres d'art qu'elles ont fabriqués.—Distinguer les zones qu'elles ont respectivement occupées.

67. Constater sur le territoire de l'Europe aux temps préhistoriques, d'après les monuments, les ustensiles, les œuvres d'art, d'après les matières premières, la mise en œuvre de ces matières, les procédés de travail et l'ornementation, l'existence de communications entre les populations établies aux extrémités opposées de l'Europe; entre ces populations et celles de l'Asie centrale.

68. Les récentes investigations paléontologiques ont révélé, sur différents

points du globe, particulièrement en Europe, des traces de la présence de l'homme à des époques antérieures aux plus anciens documents historiques. Quelles relations peut-on établir entre ces notions nouvelles et les plus anciens documents de l'histoire positive?

69. Tracer un tableau géographique et, s'il se peut, une carte de l'Égypte pharaonique avec ses divisions religieuses et administratives, au temps de Toutmès III. ou de Ramsès le Grand, en y ajoutant les pays soumis à leur empire tant en Asie qu'en Afrique; discuter la valeur des identifications des noms Coptes avec ceux des textes bibliques et classiques.

70. Géographie comparée de l'Asie occidentale et de ses divisions au temps des Sargonides et de Darius I<sup>e</sup>. Quels éclaircissements la connaissance des monuments de Khorsabed, de Babylone et de Persépolis a-t-elle apportés aux textes bibliques?

71. Parmi les monuments qui portent généralement aujourd'hui le nom d'antiquités Étrusques, ne faut-il pas distinguer des monuments appartenant à des populations d'origines diverses, notamment des populations Pélasgiques, Samnites et Ombriennes?

72. Quel est le point de départ des émigrations gauloises en Italie : le centre de la Gaule ou la vallée du Danube?

73. A quel groupe de peuples appartenaient les Daces? N'est-il pas possible d'expliquer les noms géographiques de leur territoire qui nous ont été transmis par Ptolémée, par la Table de Peutinger et par les autres auteurs ou monuments classiques, à l'aide d'un des idiomes connus?

74. Il serait curieux de connaître les documents relatifs aux navigations qui eurent lieu entre l'Égypte, le sud de l'Arabie et l'Inde pendant la période où les Lagides régnèrent en Égypte et pendant la période de l'occupation romaine de ce pays. Il se peut qu'on trouve, à ce sujet, des renseignements précieux dans les inscriptions nouvellement rapportées de l'Arabie méridionale.

75. Rechercher l'origine, définir le caractère et expliquer le but de la division de l'Italie en onze régions à l'époque d'Auguste. Comparer les divisions géographiques judiciaires de l'Italie à l'époque des *Consulares*, puis des *Juridici*, sous les Antonius, avec les provinces de l'époque de Dioclétien et rechercher l'origine de ces dernières.

76. Rechercher dans les provinces romaines (d'Auguste à Dioclétien) quelles étaient les subdivisions désignées dans les textes épigraphiques sous les noms de *dioceses* et de *regiones*. Ces subdivisions n'ont-elles pu être l'origine première des dédoublements politiques des provinces à la fin du 3<sup>e</sup> siècle? Examiner si les délégations financières des *procuratores* n'auraient pas été l'origine de ces mêmes dédoublements.

77. Est-il possible de tracer avec exactitude la limite géographique de la douane des Gaules (*quadragesima Galliarum*), à l'époque de l'empire romain?

78. Réunir et étudier toutes les bornes milliaires de la Gaule et comparer ces monuments avec les itinéraires classiques et épigraphiques.

79. Faire connaître dans les provinces romaines les principaux centres religieux du culte officiel de Rome et d'Auguste, l'étendue des juridictions religieuses des deux degrés de prêtres de ce culte, et chercher s'il n'existe pas quelque rapport entre ces circonscriptions et celles des archevêchés métropolitains et des diocèses épiscopaux.

80. Y a-t-il dans la législation barbare et particulièrement dans celle des Francs des témoignages de l'existence en Gaule, à l'époque Mérovingienne, de la Centaine géographique, c'est-à-dire de la circonscription territoriale où s'exerçait l'action du Centenier?

En quoi diffèrent la Vicairie et la Centaine géographiques, subdivisions du Comté, en Gaule, pendant la période Carolingienne?

81. Quels sont les exemplaires qui existent encore aujourd'hui des grandes cartes de Mercator ? Où les trouve-t-on ?

82. Faire connaître les résultats des recherches les plus récentes au sujet des navigations européennes le long des côtes occidentales d'Afrique et sur la route maritime de l'Inde, en dehors des navigations portugaises.

83. Progrès de la géographie au point de vue du figuré des terres, particulièrement dans les régions polaires.

84. Les observations des voyageurs contemporains ont, pour la première fois, signalé dans l'extrême Orient l'existence jusqu'alors inaperçue, ou peu remarquée, d'une race blanche à physionomie caucasique, et qui est néanmoins tout à fait distincte des nations de la grande famille Indo-Européenne, dont elle est séparée géographiquement par les rameaux de la famille Mongolique. Cette race se rencontre dans les parties orientales de l'Indo-Chine, dans la Chine méridionale, dans l'Archipel asiatique et dans la Polynésie, dans les îles du Japon et jusque dans la Sibérie orientale. Il serait important de réunir et de coordonner, en dehors de toute vue systématique, les indications éparses, et encore bien incomplètes, que l'on possède jusqu'à présent sur cette nouvelle branche de la famille humaine.

85. On a cru retrouver dans le sud de l'Inde les indices de l'existence d'une population *nègre*, que l'on rattache aux Négritos océaniens. Sur quelles données précises fournies par les sources indigènes ou par les explorateurs européens reposent ces indices ?

86. Dans la plupart, sinon dans tous les grands rameaux de la famille Indo-Européenne, on trouve une dualité de type physique parfaitement accusée, le type noir et le type blond, en opposition avec l'unité linguistique. Cette dualité se montre, dans la branche orientale, entre les Mèdes et les Hindous ; elle existe pareillement chez les Slaves, chez les anciens Grecs et chez les Celtes. Qu'a-t-on fait jusqu'à présent, ou que peut-on faire avec les données actuelles, pour expliquer ce phénomène ethnologique ?

87. Faire le relevé des notions que l'on possède, au triple point de vue physique, linguistique et géographique, sur les Gallas de l'Afrique orientale et sur les populations congénères, pures ou mélangées, qui rayonnent autour du foyer principal de la race. Cette étude devra s'étendre d'un côté sur toute la région du Nil, au-dessus de l'Égypte, et peut-être beaucoup plus loin dans le Nord-Ouest ; de l'autre, sur une partie considérable de l'Afrique australe, et probablement aussi sur de vastes régions de l'Afrique intérieure dans la direction de l'Atlantique.

88. Ne serait-il pas à désirer, dans l'intérêt des progrès de la géographie historique aussi bien que de la philologie, que l'on arrivât à composer un dictionnaire d'étymologies géographiques, avec l'indication des diverses formes (se traduisant mutuellement ou ne se traduisant pas), que le nom d'un fleuve, d'une montagne, d'une ville, d'un pays, a pu prendre à diverses époques et dans diverses langues ?

89. Quelles améliorations peut-on introduire dans l'orthographe géographique ? — Quels sont particulièrement les meilleurs moyens de transcrire en lettres de l'alphabet latin les noms écrits en caractères étrangers à cet alphabet ?

#### V. GROUPE ÉCONOMIQUE.—*Géographie Économique, Commerciale et Statistique.*

90. Quelles sont les causes générales qui portent les populations à émigrer et les États à fonder des colonies ? Quels sont les systèmes de colonisation qui ont donné jusqu'ici les résultats les plus avantageux à la métropole, d'une part, à la colonie, d'autre part ?

91. Quelles sont, en Europe, les classes de la société qui fournissent le plus d'émigrants ? Rechercher les causes qui dirigent vers certaines régions déterminées les courants d'émigration.

92. De la main-d'œuvre agricole dans les pays intertropicaux. Quelles races d'hommes sont les plus aptes à la fournir ?

93. Quels sont les meilleurs moyens d'associer les intérêts commerciaux et les intérêts scientifiques en vue des progrès de la géographie et du développement du commerce ? Quelle serait la nature du concours à demander dans ce but, soit aux groupes commerciaux, soit aux groupes scientifiques ? Quels résultats ont donné les tentatives faites jusqu'ici en vue de cette entente ? Dans quelle mesure les commerçants et les armateurs peuvent-ils servir les intérêts de la géographie en général et de la géographie commerciale en particulier, en provoquant la formation de collections où figureraient les produits, objets, documents de tout genre des différentes contrées du globe, et qui seraient accessibles au public ?

94. Indiquer les voies de communication créées ou projetées qui nécessitent, soit des percements d'isthmes, soit la construction de ponts tubulaires sur des bras de mer, soit le creusement de tunnels sous la mer ou à travers les chaînes de montagnes. Examen des difficultés vaincues ou à vaincre, des résultats obtenus ou à obtenir.

95. Résumer les opinions diverses sur la possibilité d'ouvrir un canal entre l'Atlantique et le Pacifique. Quel serait le tracé le plus avantageux ? Quelle importance peut-on assigner au trafic dans l'état actuel du commerce ?

96. Indiquer l'état actuel des communications entre l'Europe, l'Inde et la Chine ; étudier les voies projetées et rechercher celles qui offriraient le plus d'avantages au commerce.

97. Étudier les voies de communication avec l'intérieur de l'Afrique et particulièrement avec les régions du Soudan et des grands lacs. Quels sont actuellement le mode et la nature des échanges ? Rechercher quelle influence économique pourrait avoir la création d'une mer intérieure par un canal faisant communiquer la Méditerranée avec le lac Mel-Rhir.

98. Quels sont les points du globe où le commerce et l'industrie peuvent trouver des combustibles minéraux, soit en entrepôts, soit en gîtes exploitables ? Indiquer approximativement la production en combustibles minéraux dans chaque pays.

99. Rechercher quels sont les points nouveaux, dans les différentes mers du globe, qui offriraient des ressources pour les pêcheries et l'exploration des divers produits marins ?

100. Quel sont les procédés industriels de la Chine et de l'Indo-Chine, du Japon et de l'Archipel de la Sonde qui pourraient être utilisés par les fabricants européens ?

101. Quelles sont les conséquences du défrichement ou de la dévastation des forêts sur l'état commercial, industriel et agricole d'un pays ?

102. Quelles sont les lois naturelles, économiques et historiques qui président à la naissance, à la distribution sur le sol, à l'accroissement et au déclin des villes ?

#### VI. GROUPE DIDACTIQUE.—*Enseignement et Diffusion de la Géographie.*

103. Quels sont les moyens pratiques de donner plus de popularité à l'étude élémentaire de la géographie et de la topographie ?

Dans quelle mesure les cartes topographiques peuvent-elles servir à l'enseignement aux différents degrés ?

104. Quels doivent être les caractères des études géographiques dans les différentes branches de l'enseignement primaire, secondaire et supérieur ?

105. Quelle place occupe l'enseignement de la géographie commerciale, et d'après quelle méthode cet enseignement est-il donné dans les établissements destinés à former des industriels et des commerçants ?

Comparer les systèmes des divers pays.

106. Ne serait-il pas très-utile de mettre à la disposition des établissements d'instruction certains instruments géographiques ?

107. Quels sont les établissements qui ont été créés pour favoriser les travaux et les connaissances géographiques ? Quelles comparaisons peut-on faire entre eux ? Quels services rendent-ils ? Quels services plus importants encore pourraient-ils rendre ? Quels établissements nouveaux pourrait-on créer, comme centres de travaux et de connaissances géographiques ? Quels sont les moyens de coordonner et de développer les travaux des sociétés de géographie et d'en tirer tous les avantages désirables ?

108. Ne serait-il pas utile que les sociétés géographiques repussent communication des catalogues, des cartes et des ouvrages géographiques qui appartiennent aux diverses bibliothèques et archives de province, qui renferment souvent des documents très-importants, encore ignorés du monde savant ?

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VII. GROUPE DES VOYAGES.—*Explorations—Voyages Scientifiques, Commerciaux et Pittoresques.*

109. Comment pourrait-on arriver à constituer un bureau permanent chargé d'indiquer aux voyageurs, par terre ou par mer, les *desiderata* de la science géographique ?

110. Quelles sont les explorations qu'il serait plus urgent d'encourager, tant au point de vue de l'intérêt scientifique qu'au point de vue des intérêts commerciaux ?—Quels sont, en particulier, les meilleures voies à suivre, et les points de départ les plus favorables, pour remplir les lacunes que présente encore la connaissance de l'intérieur de l'Afrique ?

111. Dans les voyages d'exploration, quels sont les principaux obstacles que doivent rencontrer les voyageurs ?—Quels sont les moyens à préparer pour les surmonter ?

112. Avant de partir pour un voyage, quels sont les préparatifs utiles à faire au point de vue de l'entraînement ?

113. Quelles sont les précautions qu'exige chaque pays relativement à l'abri, au coucher, au vêtement, à l'alimentation ?—Doit-on préférer les caisses métalliques ou les autres en cuir pour la conservation de l'eau potable ?

114. Quelle conduite doit tenir un voyageur dans un milieu fanatique, particulièrement lorsqu'il est en butte à des menaces ?

115. Est-il préférable de voyager en troupes nombreuses ou en petits groupes ?

116. Quels sont les meilleurs procédés à recommander pour l'observation des latitudes et des longitudes ?

117. Instruments divers dont on peut recommander l'emploi pour des levés et des observations rapides, dans les explorations géographiques et les reconnaissances. Programme d'instructions internationales relatives à l'emploi de ces instruments et aux observations faciles à faire.

118. Que faut-il penser de l'usage du podomètre ?

119. Quels procédés doit-on recommander pour les estampages et *fac-simile* d'inscriptions et de sculptures ?

120. Quelle valeur comparative doit-on attribuer aux déterminations de hauteurs par l'emploi du baromètre ou par les procédés géodésiques ?

121. Relations de voyages en pays peu connus, et descriptions générales de contrées nouvellement explorées.

122. Provoquer la publication des relations de voyages encore inédites.

123. Quels sont les meilleurs procédés photographiques en voyage ?

The above questions have been drawn up by Special Sub-Committees, and provisionally adopted by the Scientific Section of the Committee of Organisation.

Scientific Societies and *savants* of all countries, who may have new questions to submit or modifications of those already printed to suggest, are requested to write to M. le Baron Reille, Commissaire-Général, 10, Boulevard Latour-Marbourg.

Those who intend to take part in the discussions or contribute papers on these questions, are also requested to communicate with the Commissaire-Général.

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\*.\* The Assistant Secretary of the Royal Geographical Society is instructed to reply to any inquiries about the Congress that may be addressed to him by Fellows.

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*4. On our Prospects of opening a Route to South-Western China, and Explorations of the French in Tonquin and Cambodia.* By Lieut.-Colonel A. P. McMAHON.

THE important results lately achieved by the French in the cause of geographical, ethnological, archaeological, and commercial knowledge in the hitherto *terra incognita* on the south-west of China command our admiration and sympathy. I allude, of course, to the famous expedition which left Saigon in 1866, under the guidance of Commander de la Grée, and (after his lamented death in Yunan) of Lieutenant Garnier, whose death in Tonquin we have lately had to deplore.

The importance of this expedition can hardly be over-estimated, whether we consider the admirable tact, courage, and endurance displayed by the officers\* comprising it, or the literary skill with which the results of the exploration have been embodied in a splendid work lately published under the auspices of the French Government.

The chief object of this exploration was to test the capabilities of the Mekong or Cambodia River. The gallant explorers, however, soon ascertained that it was useless as an outlet of commerce; but, wisely having been granted full discretionary powers by their Government, they were encouraged to persevere, and satisfactorily accomplished the most important journey that has been made in Asia in modern times. Impeded by rapids, they abandoned their boats, and pushed on through an unknown country, making light of dangers and difficulties that would have deterred travellers less intrepid or more trammelled with "instructions." They even made a daring détour to Talifoo, the head-quarters of the revolutionary Government, and a no less courageous and dexterous retreat therefrom; and, emerging by the Yangtse, arrived at Shanghai, after an absence of two years.

Numerous projects in view to ascertaining the best trade-route from Burma to South-Western China have long been before the public, but their discussion has hitherto not led to very important results. Baron Richthofen is of opinion that the question has already been set at rest. He declares "that the problem which has occupied many minds for a long time, whether a direct trade-route to South-Western China can be established, must henceforth be considered as settled. No one who studies the question with unbiased mind will, on sufficient examination, doubt for a moment that all the advantages are on the side of the Songka River route, and all the disadvantages on that of the Bhamo route, and no less on any other that has been, or may be, devised to enter Yunan from the west or south-west."<sup>†</sup>

Much that Baron Richthofen says is very plausible, yet to pronounce an opinion in favour of the Songka River route, to the exclusion of all others, can hardly be accepted, until we know more than we now do of the regions in the vicinity of Burma, as well as of the interior of Yunan.

The Baron reviews with much fairness and considerable acumen the various schemes to which I have adverted. He prefaces his paper with a geographical description of Yunan, in which special mention is obviously made of the mighty rivers which radiate from its plateau, but whose sources we can only vaguely conjecture; for the highways by which the peoples that dwell on their banks came down from their homes in Central Asia, must necessarily arrest the attention when considering the question.

The Yangtse, Sikiang, Songka, Mekong, Menam, Salwen, Irrawaddy, and

\* Commander D. de la Grée, Lieut. Francis Garnier, MM. Delaporte and de Carné. Dr. Joubert.

† 'Ocean Highways,' for January 7th, 1874.

Bramaputra rivers are, he points out, links in a radial system, whose outlets run their several courses through narrow and rocky gorges, and finally débouch through rich alluvial plains, populous and productive. On each of their estuaries, excepting that of the Songka, at least one great focus of commerce is situated, namely, Hankow, Shanghai, Canton, Saigon, Bangkok, Moulmein, Rangoon, and Calcutta, respectively governing the trade of the several centrifugal basins.

So soon as the region to the south of Yunan came into the possession of the English and the French, it naturally became a subject of great interest to both powers, how far the rivers flowing through their territories might be made available for intercourse with China. All have accordingly been more or less carefully explored within certain limits, and all have been declared impracticable excepting the Irrawaddy, navigable by steamers as far as Bhamo, about 900 miles up the river, and within a hundred miles of the Yunan frontier; and the Songka or Tonquin River, by which, at a distance of 500 miles from the sea, the mart of Manghau, or Mankow, in the interior of the same province, can be reached, partly by steamers and partly by boats.

In reference to the Irrawaddy, suffice it to say, there has been steam communication between Rangoon and Bhamo at least monthly, and sometimes oftener, for the last three years; and the traffic, which is safe and regular, has given an impetus to a trade which promises to be of great proportions, if proper measures are taken for its development.

Of the capabilities of the Songka comparatively little is at present known. But when it was definitely settled that the Mekong or Cambodia was not navigable, the explorers suggested an alternative route by the Songka through the Tonquin Valley—an idea attracting little general notice at the time, but accepted as reasonable by many who had studied the subject, as well as of sufficient importance to put us more on our mettle in reference to the opening out of the trade-routes from Burma. The solution of this problem was, says Baron Richthofen, "reserved to the skill and enterprise of M. Dupuis. This gentleman visited Yunan for the first time in 1869, with the object of offering European firearms and cannon to the mandarins in command of Imperial troops, for use against the Mahomedan rebels in Yunan and the Miautze tribes in Kweichau. He was well received by the Governor-General and the military authorities, and encouraged to return. In 1870 he went a second time, carrying with him a large quantity of arms and munificent presents, and determined to return to the coast by way of the Songka River, if it should be navigable. The authorities favoured this plan, seeing at once how profitable it might be for them to have so short a road opened for receiving their supplies from the coast. Proceeding by way of Ling-quan-su and Mong-tshien, M. Dupuis reached the mart of Mang-hau, situated on a small affluent of the Songka, after twelve days' travel from Yunanfu, and found that place to be the navigable head."

Now, much as we may admire the tact, courage, and ability displayed by M. Dupuis, in successfully carrying out his enterprise in the face of great difficulty, in common fairness, I think, the credit of discovering the Songka route must be ascribed to the officers of the French expedition as already indicated.

"The charge of developing the navigation of the Tong-King River, to which he (Lieut. Garnier) justly attached so great an importance, he had," says Colonel Yule, "apparently resigned to the urgent ambition of one of his comrades on the Mekong, Lieut. Delaporte."†

And in a letter to Colonel Yule, written a few days before his death, Lieut. Garnier tells us the part taken both by M. Dupuis and himself, which is

\* 'Ocean Highways,' for January 1874.

† 'Ibid., March 1874.'

corroborated by a correspondent of the 'Times.'\* "Les autorités Chinoises," he writes, "qui se sont beaucoup aidées d'un négociant français nommé Dupuis, ont applaudi à sa tentative de leur ouvrir un débouché vers les côtes par le fleuve de Tong-King que j'avais indiqué dès mon retour en France comme une route commerciale à étudier. Enfin les entraves apportées par la cour de Hiré, malgré notre recommandation, au passage des navires de ce M. Dupuis, ont amené l'Amiral de Saigon à intervenir."†

The most prominent suggestions for communication between Trans-Gangetic India and China are so well known that it will be sufficient for my purpose merely to enumerate them:—

I. To construct a road from Sudiya on the Bramaputra direct to Western China.

II. To run a railway between Rangoon and Kian-hung, &c., known as Captain Sprye's route.

III. To re-open the old trade-route between Bhamo and Talifoo.

Baron Richthofen disposes of the first as an "utterly chimerical scheme," on account of the great physical and political difficulties attending it. The second he also condemns on commercial grounds; while the third receives only his qualified approval.

Baron Richthofen's argument in favour of the Songka route is as follows:—

1. "The Songka affords the only navigable water-route connecting Yunan directly with the sea.

2. "It constitutes, from the head of its navigation *within* the province, a shorter route than any one of the other rivers that radiate from Yunan does from its head of navigation outside the province.

3. "The mart of Manghau, situated at the head of navigation, is of shorter and much easier access from the most productive and most populous portions of Yunan than those marts (Péséfu, Suchanfu, Bhamo) which occupy the same position relatively to other rivers (Sikiang, Yang-tse-kiang, Irrawaddy) or Kiang-hung on the Mekong, which has been designed as a railway terminus.

4. "Manghau is the only place which—a competition on equal terms of all places situated round Yunan being supposed—is capable of supplying the main portion of the province, or taking up its chief products for exportation.

5. "Starting from Manghau, and accomplishing a rapid ascent of 5000 to 6000 feet, a plateau, on which Mong-tsz-hien is situated, Yunanfu can be reached by an easy road; whereas the *real difficulties of the Bhamo route commence east of Momein or Tung-que-chan*, reached by Major Sladen."

Of these propositions the first and second are self-evident, while the remainder, based apparently on the evidence of native traders, are, we think, open to exception. The same may be said in reference to the information collected by Major Sladen and his colleagues. Their impression, from inquiries made on the spot, was that good and practicable roads connect all the great centres of commerce with Momein.

Captain Bowers states that there are two good roads thence to Yunchan—one direct to the east, the other in a more northerly direction; and also notes that "the road to Talifoo is represented as paved nearly all the way."‡

I have frequently conversed with Chinese and Mahomedan traders at Mandalay and Bhamo, and all agreed that the revolution in Yunan—now happily at an end—was the only drawback to opening up the ancient trade-routes.

Although Marco Polo, the only European traveller who has gone over this

\* 'The Times,' April 4, 1874.

† 'Ocean Highways,' March 1874.

‡ Captain Bowers' Report, pp. 76 and 77.

road, tells us little in reference to its physical features, it is reasonable to suppose the great Venetian would have made some sign if the difficulties to be encountered therein were so exceptional as Baron Richthofen's informants would lead us to imagine.

But with reference to the merits of the question as to whether Burms or Tonquin is the more easily accessible from Yunan, history\* teaches us that the Chinese on more than one occasion found no difficulty in marching large armies into Burma by the Bhamo route, while their persistent efforts to penetrate Tonquin invariably failed. Possibly the greater valour of the Tonquinese may have contributed to the latter result; but as the Burmese were by no means deficient in bravery in their contests with the Chinese, or in their skill in taking advantage of natural impediments to an enemy, we may reasonably conclude that the physical difficulties with which the approaches to Tonquin were encumbered contributed not a little to the successes of its people.

But even if it be true that the Songka route dominates the greater share of the trade of Yunan, and that we must judge of the respective merits of different schemes by the commercial advantages they offer, valid reason can hardly be adduced for our neglecting to secure so much of the trade as properly belongs to us, and prevent its diversion by less natural channels. Not that we should jealously grudge a legitimate increase of French trade with the countries adjoining their possessions, but we should take our fair share in their development, instead of suggesting difficulties as an excuse for our inaction.

Many indignant philippics censuring the "masterly inactivity," as well as the active hostility of the King of Burma, have appeared in the Indian press, but no practical suggestions as to the course his Majesty should adopt towards a satisfactory solution of this difficulty, have, as far as I am aware, been offered.

His Majesty's policy, as frequently enunciated, was—

1stly. To disconcert the pretensions of the Mahomedans or Panthays, considering them rebels against his treaty friends, the Chinese.

2ndly. To deprecate attempts to revive the trade-routes while confusion existed in Yunan, but to co-operate with us towards the attainment of this object so soon as order was restored.

Recent events have proved the soundness of his Majesty's policy in reference to the Panthays; and now that the Chinese are again in the ascendant, and the trade-routes opened for traffic, it is to be hoped that he will keep his word, and grant us facilities for exploring his own outlying territory, as well as the countries adjoining his dominions.

The obstructiveness of the Chinese traders, again, has been much insisted on, with little reason.

They certainly opposed European traders when the latter first endeavoured to improve their trading relations with the capital, but when they found that as agents for English firms their profits vastly increased, they were soon reconciled to the innovation.

With the resuscitation of the ancient trade-routes, they know, for the same reasons, they will be great gainers; nor will they allow any sentimental antagonism to foreigners to interfere with their own material prospects.

The same may be said of the alleged rapacity and impracticability of the Chinese mandarins and the chiefs of savage tribes.

It is simply a question of money with the one, of beads, looking-glass, or Turkey-red cloth, as the case may be, with the other. There are taxes (looking from their stand-point) somewhat unreasonably resented by us, when we

\* *Maha Rajuvan*, or Burmese 'History of the Kings.' Chinese official reports of the invasion of Mien, or Burma. Dr. Gutzlaff's papers in the 'Journal of the Royal Geographical Society,' in reference to Tonquin.

consider that in the Indo-Chinese region the government dues are farmed out instead of directly levied as with us.

The wild tribes on our borders, long notorious for their turbulence and ferocity and for their hostile and independent bearing to their former nominal rulers, have relinquished their evil ways, and evince the liveliest respect and goodwill towards the English Government.

These results are entirely due to the labours of Christian missionaries, as well as to the tact, discretion, and firmness displayed by the officers of the British Burma Commission in their dealings with them.

There are many who have participated in this good work, ready and willing to give the benefit of their experience in other lands, so that the dread of complication arising beyond our frontier, with peoples whom it may be inconvenient to call to account for possible wrongs inflicted on our countrymen, need no longer be entertained.

While, then, we may heartily congratulate the French on what they have achieved in the cause of geography and other sciences, geographers, to whatsoever nationality they belong, will doubtless be of opinion that much remains to be done before the question as to which is the most practicable route to South-Western China is satisfactory solved.

*London, 6th April, 1874.*

5. *Letter from LIEUT. CAMERON, R.N., commanding the Livingstone East-Coast Aid Expedition.\**

“ Kawèlè, Ujiji, on the Tanganyika Lake,  
March 2nd. [1874.]

“ SIR,

“ I have the honour to report my arrival here, and to forward, for the information of the President and Fellows, a map of my journey from Kwi-harah to Ujiji: as travelling on the other side of the lake is impracticable for some time, I intend in a few days to go for a cruise round the southern end, and, if I find time allows, to circumnavigate the lake completely. I have obtained a very fine large canoe, pulling 14 oars and fitted with a sail. I sent the rough journal of my doings since leaving Kwi-harah home, and they will copy it out fairly and send it you. I also enclose a letter for Her Majesty's Principal Secretary of State for Foreign Affairs regarding what I have seen with regard to the slave-trade, which, I hope, may be forwarded if the President and Council have no objection.

“ If I receive safely some beads I was obliged to leave behind on account of lack of portage, I shall have stores which ought to last for 18 months if necessary, except that I require some cloth for clothing the askari and monthly pagazi.

“ I have been very unfortunate in having a number of thieves amongst the pagazi, having lost ten loads through theft on the road: all the men that I found out who had anything due I discharged on arrival here, without giving anything; but, unfortunately, several of the thieves were engaged at Unyanyembe for the journey here, and had received, as is the custom, the whole of their pay before starting, so that I had no means of punishing them, save keeping them in irons after their detection, and giving them a sound flogging on discharge.

“ I have placed Kasenge, Kabogo, and Pt. Malagarazie on the map by cross-bearings from Kawèlè and Bangwè.

“ March 4th.—I leave this for my cruise on the 6th instant, and intend, as far as time allows, to make a sextant and compass survey of the lake. I see that Burton in one instance allows his variation the wrong way. The variation now is 17° westerly.

“ Trusting that my proceedings up to this will meet with the approval of the Society,

“ I have the honour to be, Sir,

“ Your most obedient humble servant,

“ V. LOVETT CAMERON, R.N.

“ P.S.—With regard to the large expenditure at Kwi-harah, I beg to state that, without the purchases I had made, we should all have had to return, and prior to the news of Dr. Livingstone's death, which I knew could not be the wish of the Society; and when the sad news arrived, I found that the stores could not be resold, and therefore would have been a dead loss, as well as the wages of the pagazi to this place, and could only be utilised by travelling. What further expenditure has occurred, has been principally entailed by the desertion of pagazi, who, as I have said before, were induced to run by some of the low-class Arabs in Unyanyembe.

“ I find, on arrival here, that no large caravan has come here since our arrival at Unyanyembe, and that one which started whilst we were [there] had to return.

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\* Vide ‘Proceedings,’ p. 283.

" Small parties of up to 10 or 12 men get through by travelling at night and camping in the day time in the jungle away from the road.

" Parties of Waguhhu, Wavinzu, and Wanyamwesi also get by in the same manner.

" Between Liowás village and Uvinza we were hard up for food ; I had for days together to live on dry mtama-bread, which is not the best food for travelling on, especially when one can't get enough of it.

" Here, however, food is good, plentiful, and cheap.

" I anticipate little or no trouble on the other side about porters, and to Nyangwe intend travelling with the Arabs when they set out.

" I am, &c.,

" V. LOVETT CAMERON, R.M."

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**PRISE MEDALS**  
OF THE  
**ROYAL GEOGRAPHICAL SOCIETY.**

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**REPORT FOR 1874**  
**AND**  
**PROGRAMME FOR 1875.**

## PRIZE MEDALS

OF

## THE ROYAL GEOGRAPHICAL SOCIETY.

	PHYSICAL GEOGRAPHY.	POLITICAL GEOGRAPHY.
<b>1869.</b>		
Gold Medal .. .. ..	GRUNDY.	RICHMOND.
Bronze Medal .. .. ..	GENT.	WILDE.
<i>Honourably Mentioned</i> Butler, Stewart, Wilson, Brown, Thomas.		Crabb, Collins, Lewis, Dixon, Bontflower.
<b>1870.</b>		
Gold Medal .. .. ..	BUTLER.	GENT.
Bronze Medal .. .. ..	STEWART.	COLLINS.
<i>Honourably Mentioned</i> Hind, Hughes, Beckly, Hunt, Shawe, Thomas.		Crabb, Grundy, Hogben, Murray, Dixon.
<b>1871.</b>		
Gold Medal .. .. ..	MCALISTER.	HOGBEN.
Bronze Medal .. .. ..	COLLINGWOOD.	ARKLE.
<i>Honourably Mentioned</i> Lundie, Shaw, Hudson, Beckley, Disney, Evill, Brown, Fooks.		Sparks, Heath, Bontflower, Hassall.
<b>1872.</b>		
Gold Medal .. .. ..	SPRING-RICE.	COLLINGWOOD.
Bronze Medal .. .. ..	BUTLER.	GRAHAM.
<i>Honourably Mentioned</i> Penrose, Dickson, White, Vane.		Sayle, Kingsford, Dixon.
<b>1873.</b>		
Gold Medal .. .. ..	HUDSON.	SPRING-RICE.
Bronze Medal .. .. ..	FORBES.	NUTT.
<i>Honourably Mentioned</i> Cole, Reade, Hancock, Louis, Richardson, Pawle, Townsend, Widdicombe.		Williams, Kingsford, Sing, Saunders, Hassall.
<b>1874.</b>		
Gold Medal .. .. ..	WESTON.	TURTON.
Bronze Medal .. .. ..	MONTAGUE.	JACOB.
<i>Honourably Mentioned</i> Platnauer, Widdicombe, C. A. Spring-Rice, Miers, Healy, Wilson, Forsyth.		Heyes, Saunders, Whiston, Styer.

## PRIZE MEDALS

OF THE

## ROYAL GEOGRAPHICAL SOCIETY.

INSTITUTED, 1869.

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RESULTS OF THE EXAMINATION FOR 1874.

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*List of Schools who were invited to compete in 1874.*

*English Schools.*—St. Peter's College, Radley, Abingdon; King Edward's School, Birmingham; Brighton College; Bristol Grammar School; Cathedral Grammar School, Chester; Cheltenham College; Clifton College; Dulwich College; Eton College; Haileybury College; Harrow; Hurstpierpoint; Liverpool College; Liverpool Institute; London,—Charter House; Christ's Hospital; City of London School; King's College School; St. Paul's; University College School; Westminster School; Royal Naval School, New Cross;—Malvern College; Manchester School; Marlborough College; University School, Nottingham; Repton; Rossall; Rugby; King's School, Sherborne; Shoreham; Shrewsbury; Stonyhurst College, Blackburn; Tonbridge School; Uppingham School; Wellington College; Winchester College.

*Scotch Schools.*—Aberdeen Grammar School; Edinburgh Academy; Edinburgh High School; Glasgow High School.

*Irish Schools.*—Royal Academical Institute, Belfast; Dungannon Royal School; Ennis College; Portora Royal School, Enniskillen; Foyle College, Londonderry; Rathfarnham, St. Columba's College.

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Fifteen of the above Schools furnished competitors, according to the following list, in which is entered the number of candidates in Political and Physical Geography from each school:—

		Physical.	Political.
Cathedral Grammar School, Chester	.. .. ..	0	1
Marlborough College	.. .. ..	2	0
University School, Nottingham	.. .. ..	1	0
Malvern College	.. .. ..	1	0
Haileybury College	.. .. ..	1	0
City of London School	.. .. ..	3	1
Eton College	.. .. ..	4	0
Hurstpierpoint College	.. .. ..	0	2
Liverpool College	.. .. ..	4	1
Dulwich College	.. .. ..	1	1
Clifton College, Bristol	.. .. ..	0	2
Rossall School	.. .. ..	0	1
University College School	.. .. ..	1	2
Cheltenham College	.. .. ..	1	0
Repton	.. .. ..	0	1
Total	..	19	12

The Examiners appointed by the Council for 1874 were Professor A. C. Ramsay, LL.D., &c., for Physical, and the Rev. Canon Rawlinson, M.A., for Political Geography. The examinations were held at the various schools, on the 16th of March, and the Prizes were presented at the Anniversary Meeting of the Society.

The special subject for the year 1874 was—

#### THE BRITISH ISLES.

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### PHYSICAL GEOGRAPHY.

#### NO. 1 EXAMINATION PAPER, 1874.

##### General.

[Candidates are not to answer more than Twelve Questions in this Paper.]

- (1). What is a glacier, and how are glaciers formed and maintained ?
- (2). Lake basins are often enclosed all round by solid rock-boundaries. Give a few well known cases, and account for the origin of such basins.
- (3). Name one other kind of rock-bound lake-basins, the origin of which is quite different.
- (4). Draw a sectional diagram of the country along a straight line from the mouths of the Ganges across the Himalaya to the mouth of the Obi in Siberia, expressing the elevation and general surface contour of the country traversed.
- (5). Many of the lakes of Central Asia are salt. Why is it that they must be gradually getting salter, notwithstanding the influx of fresh rivers into them ?

- 6). What is the reason that the east-winds (blowing from the sea) on the Eastern coasts of the northern half of North America are generally cold, and the western winds blowing from the sea over the West of Europe are apt to be warm ?
- (7). Why is it that the greater glaciers of the Himalaya all flow southerly ?
- (8). Name the three kinds of coral reefs described by Darwin, and briefly explain the theory of the formation of coral reefs ; and state also the oceanic areas in which they are found.
- (9). Draw a line from the Atlantic Sea across the Dovrefield of the Scandinavian chain to the northern end of the Caspian Sea, and express the general contour of the country traversed by that line by a diagram.
- (10). What are the distinctive physical features of Antarctic Victoria Land ?
- (11). Explain the theory of the spasmodic ejection of the hot water of Geysers.
- (12). What is the distinctive character of the Mammalian Fauna of Australia as compared with the Mammalian Fauna of the great continental areas of Europe and Asia ?
- (13). State those areas in Europe, Asia, and North America, in which lakes are very numerous.
- (14). Give a brief description of the course of the River Po, the effect of the artificial dykes that restrain it, and the proofs of the gradual increase of its delta.
- (15). What is the effect of the great lakes of North America on the deposition of sediment at the mouth of the St. Lawrence ?
- (16). Icebergs are very numerous in Baffin's Bay, and float south into the North Atlantic ; what is the origin of such icebergs, and why do they often float against the wind ?
- (17). What is a Fiord ? Name those areas of the world in which Fiords are most numerous.
- (18). Name any area or areas of land that have been sensibly raised above the sea within the historic period, in connection with the phenomena of earthquakes and volcanos.

## No. 2 EXAMINATION PAPER, 1874.

## Special.

## THE BRITISH ISLES.

*[Candidates are not to answer more than Eight Questions in this Paper.]*

- (1). By what phenomena can you prove that great sheets of Glacier ice formerly covered large areas of the British Islands ?
- (2). What is the reason that the amount of rainfall in Britain is generally so much greater in the western than in the eastern region ?
- (3). What is the reason why so many of the western-flowing rivers of England consist of what is commonly called soft water, while the eastern-flowing rivers are more generally hard ?

- (4). The Thames has its sources on the Oolitic Table-land near Cheltenham, and flows eastward through a high escarpment of the chalk. By what means has it happened that the river *seems* to have made a breach through this apparent scarped barrier?
- (5). Suppose a straight line drawn from Menai Straits over the top of Snowdon to London. Draw the general contour of the country traversed by that line, and state why it happens that the north-western half is mountainous, and that the south-eastern half consists of table-lands, plains, and minor undulating hills?
- (6). What relation is there between the physical geography and physical geology of Great Britain and the different races of men that inhabit it?
- (7). How would you prove that England must have been joined to the Continent in times comparatively recent?
- (8). What are the principal distinctive physical features of Ireland, as regards mountains, plains, lakes and rivers?
- (9). Name those districts of England and Scotland in which lakes are numerous, some of those in which there are none, and account for these circumstances.
- (10). Why is it that the average temperature of Ireland and the Western Coast of Great Britain is more equable than that of the Eastern Coast?
- (11). Give a brief sketch of the general distribution of moorlands, pasture-lands, and land on which grain and other farm-crops are grown in Britain.
- (12). Draw a line from the Grampian Mountains over the Lammermuir Hills to the north of England, near Newcastle, and give the general outline of the country above the level of the sea.
- (13). On what parts of the Coast of Great Britain is the waste of the cliffs most rapid, and what is the cause of this waste?
- (14). Describe the general physical features of the *Great Glen* that intersects Scotland between Loch Linnhe and the Moray Firth.

## POLITICAL GEOGRAPHY.

### No. 1 EXAMINATION PAPER, 1874.

#### General.

*[Candidates are not to answer more than Twelve Questions in this Paper.]*

- (1). Follow round the globe the line of the fortieth degree of north latitude, and state the countries, seas, and islands which it traverses. Note, and account for, the chief differences of climate along the line; and give, in geographical miles, the distance, one from another, of the chief towns through (or close to) which the line passes.
- (2). Follow southwards the meridian of St. Petersburg, and give an account of the several countries lying under it—their area, physical character, population, form of government, commercial advantages or disadvantages, and the ethnic character of their inhabitants.
- (3). Give the political divisions of Europe at the following periods: A.D. 100; A.D. 600; A.D. 1500.

- (4). What is the height, actual or relative, of the following mountains, and where is each of them situated? Chimborazo, Cotopaxi, Demavend, Everest, Etna, Hecla, Lebanon, Monte Rosa, Schreckhorn, Stromboli, Teneriffe, Viso.
- (5). What are the respective advantages and disadvantages of mountains and rivers as political boundaries? Which seem to have been preferred (1) by the Greeks, (2) by the Romans? Illustrate from their history.
- (6). Trace the changes in the lines of trade between Europe and India from the earliest times to the present day; and show the causes of change in each instance.
- (7). What European states possess colonies or dependencies in the New World? Give the area (approximately), the geographical position, the present population, and the chief productions of each possession.
- (8). Trace the changes in the political divisions of Italy between 1815 and the present time.
- (9). What would be the chief difficulties in the construction and maintenance of a railway between Scutari and Kurrachee upon the Indus? Describe the political condition of the countries through which it would have to pass.
- (10). Give an account of the present distribution of races in Europe; and say what is known of the migrations of any of them.
- (11). Show that geographical knowledge, while it has in the main advanced steadily, has occasionally, in certain respects, receded.
- (12). Give as complete an account as you can of the trade which passes through the Dardanelles.
- (13). Among what States is South America divided? What is the size, position, population, and political condition of each?
- (14). What are the chief regions of the earth which are still unexplored, and what are the difficulties which interfere with the exploration of each?
- (15). What geographical conditions favour, respectively, the formation of large and small states? Examine, historically, the question how far the geographical tendency may be counteracted by other causes.
- (16). The existing distribution of the Semitic family of mankind; its chief subdivisions, present and past; and the causes that have checked its wider extension.

## No. 2 EXAMINATION PAPER, 1874.

Special.

## THE BRITISH ISLES.

*[Candidates are not to answer more than Eight Questions in this Paper.]*

- (1). Draw a map of South Britain in the middle Saxon period (A.D. 617-700), marking the boundaries of the Seven Saxon Kingdoms, and showing what portions of the country remained unconquered. How far do the geographical conditions explain the continuance, in these districts, of British independence?
- (2). Give an account of the chief ethnic elements in the population of the British islands, and say how they are distributed. What local terms indicate the prevalence, in different districts, of the several elements?

- (3). Trace the lines of the Roman Walls in Britain, and of the *five* principal Roman Roads or "Streets." Give the names and positions of the chief Roman settlements along the line of each "Street." In what places along them do there still exist important Roman remains?
  - (4). Explain the following words and phrases: Cantire, *Cinque* Ports, Connemara, Cornwall, Danelagh, *Isle* of Ely, Strathclyde, Strathmore, Torbay, Turlough.
  - (5). Enumerate, from south to north, the *inland* counties of Scotland. Give (approximately) the area and population of each. Mention their chief towns and products.
  - (6). How far is density of population in England and Wales determined by the distribution of mineral treasures? How far by advantages of commercial position? How far by other causes?
  - (7). What changes have taken place in the amount of the population of Ireland within the present century? To what causes are they attributable? And how far has the increase, or decrease, been uniform in different parts of the country, or the contrary?
  - (8). Compare Ireland and Scotland with respect to area, present population, natural productiveness, and actual present production. What are the chief seats of manufacturing industry in the two countries, and what are their chief exports?
  - (9). What are the respective advantages of railways and canals as means of commercial communication? Mention the principal canals in England and Scotland, and trace the line of each.
  - (10). What counties are included, wholly or in part, within the basin of the River Humber? Name all the important towns which lie on the Humber or its tributaries; and say to what point each tributary is navigable.
  - (11). Estimate, in acres, the amount of land in England and Wales. How much of it is naturally unproductive? Of the portion naturally productive, how much is cultivated (*a*) by tillage, (*b*) as pasture? Where do the unproductive portions principally lie?
  - (12). Name the chief islands off the western coast of Scotland, and say to what counties they are respectively reckoned. Give (approximately) the area of each, and state their distance from the mainland, and the ordinary employments of their population.
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The following are the names of the successful competitors:—

### PHYSICAL GEOGRAPHY.

		Age.		
Gold Medal ..	LOUIS WESTON ..	17 .. ..	<i>City of London School.</i>	
Bronze Medal ..	FRANCIS CHARLES MONTAGUE ..	$\left\{ \begin{matrix} 15\frac{1}{2} \\ .. \end{matrix} \right.$	<i>University College School.</i>	

### Honourably Mentioned.

		Age.		
	H. M. PLATNAUER ..	16 $\frac{1}{2}$ .. ..	<i>City of London School.</i>	
	W. S. WIDDICOMBE ..	17 .. ..	<i>Haileybury College.</i>	
	C. A. SPRING-RICE ..	14 .. ..	<i>Eton College.</i>	
	H. A. MIERS ..	15 .. ..	<i>Eton College.</i>	
	C. HEALEY ..	18 .. ..	<i>Malvern College.</i>	
Equal.	W. F. WILSON ..	17 .. ..	<i>Liverpool College.</i>	
	A. R. FORSYTH ..	15 .. ..	<i>Liverpool College.</i>	

### POLITICAL GEOGRAPHY.

		Age.		
Gold Medal ..	W.M. HARRY TURTON ..	17 .. ..	<i>Clifton College, Bristol.</i>	
Bronze Medal ..	LIONEL JACOB ..	16 .. ..	<i>City of London School.</i>	

### Honourably Mentioned.

		Age		
	J. F. HEYES .. .. ..	16 .. .. ..	<i>Liverpool College.</i>	
	S. H. B. SAUNDERS ..	17 .. .. ..	<i>Dulwich College.</i>	
	ROBT. WILMOT WHISTON ..	17 .. .. ..	<i>Repton School.</i>	
	W. B. STYER .. .. ..	16 .. .. ..	<i>University College School.</i>	

## REPORTS OF THE EXAMINERS FOR 1874.

## I.—PHYSICAL GEOGRAPHY.

*To the Council of the Royal Geographical Society.*

GENTLEMEN,

KENSINGTON, 6th April, 1874.

I have to report that eighteen candidates competed for the prizes in Physical Geography.

The result is shown as follows—each of the questions having been valued at ten, thus giving a maximum of 200 marks for the twenty questions to be answered in the general and special papers:—

Gold Medal .. LOUIS WESTON.

Bronze Medal .. FRANCIS CHARLES MONTAGUE.

*Honourably Mentioned.*

HENRY MAURICE PLATNAUER.

WILLIAM S. WIDDICOMBE.

CECIL ARTHUR SPRING-RICE.

HENRY ALEXANDER Miers.

CHARLES HEALY.

Equal. { WILLIAM FORSHAM WILSON.  
ANDREW RUSSELL FORSYTH.

The number of marks gained by Louis Weston shows, in my opinion, that he deserves to receive the Gold Medal, and Francis Charles Montague, who is not far behind him, must therefore well deserve the Bronze Medal. Henry Maurice Platnauer, William S. Widdicombe, and Cecil Arthur Spring-Rice, come next in order of merit, closely approaching to that of Francis Charles Montague.

Taken as a whole, a large proportion of the papers are very creditable to the pupils. The knowledge that many of the candidates display has evidently involved a good amount of close reading and appreciation of the subjects studied.

When the answers to the questions in General and Special Geo-

graphy are respectively averaged, taken in the proportion of 8 to 12, the value of the answers slightly preponderates on the side of the General questions.

I may remark that very few have introduced any matter irrelevant to the questions, though one or two have wasted time in what is commonly called "fine writing."

The drawing of contoured lines across a continent, or other large section of any country, is sometimes very fairly done, showing a good appreciation of proportion regarding the general height and slopes of the ground, but sometimes the drawing is so grossly exaggerated and so feeble that it simply amounts to a caricature of the district traversed by the line.

I am your obedient servant,

ANDREW RAMSAY.

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## II.—POLITICAL GEOGRAPHY.

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*To the Council of the Royal Geographical Society.*

GENTLEMEN,

PRECINCTS, CANTERBURY,  
March 27th, 1874.

I have the honour to present to you the following as the result of the Examinations for the present year in Political Geography :—

1. Gold Medal .. W. H. TURTON.
2. Bronze Medal .. L. JACOB.

### *Honourably Mentioned.*

J. F. HEYES.	Æquales.
S. H. B. SAUNDERS.	
R. W. WHISTON.	

W. B. STYER.

The number of candidates who competed for Political Geography in the present year was twelve. Of these, six may be said to have done well, and two others fairly. The work of the remaining four was very inferior. The Gold Medallist surpassed the next competitor by a hundred marks, out of a total of 750. His answers were almost uniformly good, and he had prepared equally well the general and the special subject. He attempted, however, only ten questions instead of twelve on the general subject. The Bronze Medallist,

who answered the full number of twelve questions, obtained rather more marks for his general paper than the Gold Medallist ; but the special paper of the latter was very much superior to that of his chief antagonist. The second and third on the list fell short of the Bronze Medallist by about fifty marks ; the fifth was fifty marks below them ; the sixth was separated by a somewhat longer interval from the fifth.

On the whole, the general was done better than the special paper. The map of England (set in Q. 1) was tried by eight, but outlined with fair correctness by only one. The books recommended by the Prizes Committee appeared to have been carefully studied ; but, where the questions went beyond those books, either no answers were given, or, for the most part, very poor ones. The superiority, however, of the better candidates was especially shown in their answers to questions of this kind, which were sometimes decidedly good.

The examination seemed to me, as a whole, fairly satisfactory though more accuracy and exactness is much to be desired ; and the random use of figures, where the candidate must feel that he has no real knowledge of the true number, is much to be regretted.

I have the honour to be, Gentlemen,

Your obedient servant,

GEORGE RAWLINSON.

## PROGRAMME FOR 1875.

THE Council of the Society have satisfaction in repeating the offer of Prize Medals for the ensuing year, and have invited the following Public Schools to take part in the competition:—

*List of Schools invited to compete in 1875.*

*English Schools.*—St. Peter's College, Radley, Abingdon; King Edward's School, Birmingham; Brighton College; Bristol Grammar School; Cathedral Grammar School, Chester; Cheltenham College; Clifton College; Dulwich College; Eton College; Haileybury College; Harrow; Hurstpierpoint; Liverpool College; Liverpool Institute; London,—Charter House; Christ's Hospital; City of London School; King's College School; St. Paul's; University College School; Westminster School; Royal Naval School, New Cross;—The College, Malvern; Manchester School; Marlborough College; University School, Nottingham; Repton; Rossall; Rugby; King's School, Sherborne; Shoreham; Shrewsbury; Stonyhurst College, Blackburn; The School, Tonbridge; Uppingham School; Wellington College; Winchester College.

*Channel Islands School.*—Victoria College, Jersey.

*Scotch Schools.*—Aberdeen Grammar School; Edinburgh Academy, Edinburgh High School; Glasgow High School.

*Irish Schools.*—Royal Academical Institute, Belfast; Dungannon Royal School; Ennis College; Portora Royal School, Enniskillen; Foyle College, Londonderry; Rathfarnham, St. Columba's College.

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*Syllabus of Examinations for the Prize Medals of the ROYAL  
GEOGRAPHICAL SOCIETY in 1875.*

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## EXAMINATION IN PHYSICAL GEOGRAPHY.

This Examination will take place simultaneously at the several invited Schools, according to printed regulations (which will be forwarded in due time), on the third Monday in March, 1875, and will consist of two papers of three hours each; the one to be answered between 9 and 12, 9½ and 12½, or 10 and 1 A.M. (according to the convenience of the School); and the other between 2 and 5, 2½ and 5½, or 3 and 6 P.M.

N.B. It is necessary, in order that Candidates may be admitted to the Examination, that their names be sent in to the Secretary of the Society on or before the *first* Monday in March.

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*No. 1 Examination Paper* will consist of questions on the following subjects :—

A. *Configuration of the Earth*, as learnt by careful study of a globe. What are the distances, speaking roughly, between such remote places as may be specified? What places of importance lie on the direct lines between them, and what is the section along each? What are the relative size, elevation, &c., speaking roughly, of such well-known districts, mountains, and rivers, as may be specified?

B. *General Physical Geography*.—Distribution of land and sea, forests, plateaux, glaciers, volcanoes, man, animals, plants and minerals, climates and seasons, oceanic, meteorological and magnetic phenomena.

\* \* Extra marks will be allowed for sketches, but only so far as they are effective illustrations of what cannot otherwise be easily expressed. The use of blue and red pencils is permitted for this purpose. No marks will be given for neatness of execution, apart from accuracy.

The candidates may be required to construct a rough map without the aid of special instruments, but from a brief description of a district illustrated by itineraries and bearings.

*No. 2 Examination Paper* will consist wholly of questions on a special subject.

The special subject appointed for 1875 is—

CHINA.

#### EXAMINATION IN POLITICAL GEOGRAPHY.

This Examination will take place simultaneously at the several invited Schools, at the same hours and under precisely the same regulations as those in Physical Geography.

*No. 1 Examination Paper* will consist of questions on the following subjects :—

A. *Descriptive Geography*.—Explanation of latitude and longitude. What are the distances in geographical miles, speaking roughly, and as learnt by the careful study of a globe, between such remote places as may be specified? What places of importance lie on the direct line between them? What is the relative size, speaking

roughly, of such well-known countries, mountains, and rivers, as may be specified?

B. *Historical Geography*.—Embracing (1) the boundaries of states and empires at different historical periods; (2) the chief lines of commerce, ancient and modern; (3) the influence of geographical features and conditions upon the distribution of races and political history of mankind.

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No. 2 *Examination Paper* will consist wholly of questions on a special subject.

The special subject appointed for 1875 is—

#### CHINA.

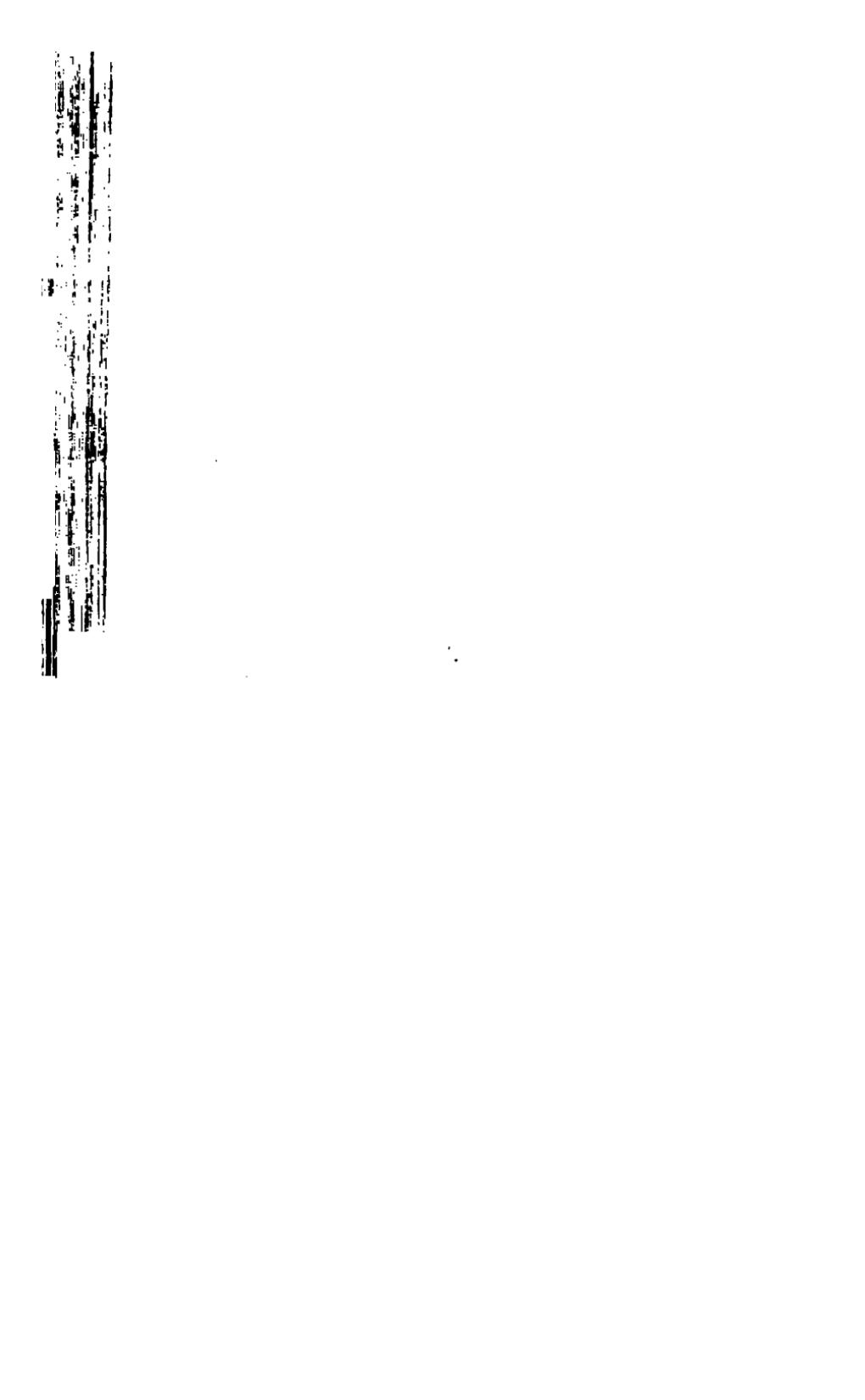
\* \* Extra marks will be allowed for maps and sketches, but only so far as they are effective illustrations of what cannot otherwise be easily expressed. The use of blue and red pencils is permitted for this purpose. No marks will be given for neatness of execution, apart from accuracy.

The candidates may be required to construct a rough map without the aid of special instruments, but from a brief description of a district illustrated by itineraries and bearings.

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The following books and articles contain much information regarding the Historical, Political, and Physical Geography of China.

1. 'The Middle Kingdom; a Survey of the Chinese Empire,' &c. By S. W. Williams. 2 Vols. Wiley and Putnam, London and New York. 1848.
2. 'The Imperial Gazetteer.' Edited by W. G. Blackie, PH.D. Article "Chinese Empire." Blackie and Son. 1873.
3. 'The English Cyclopaedia,' Geography, Vol. II. Article "China." Bradbury and Evans. 1870.
4. 'The Treasury of Geography.' Edited by Prof. W. Hughes. Longmans. 1872. 6s.



PROCEEDINGS  
OF  
THE ROYAL GEOGRAPHICAL SOCIETY.

[ISSUED SEPTEMBER 4TH, 1874.]

SESSION 1873-4.

*Fifteenth Meeting (ANNIVERSARY), 1 P.M., June 22nd, 1874.*

The RIGHT HON. SIR H. BARTLE FRERE, K.C.B., PRESIDENT,  
in the Chair.

The business of the Meeting was prefaced by the Secretary, Mr. R. H. MAJOR, reading the clauses of the Regulations which govern the Anniversary Meetings of the Society, and also the Minutes of the preceding Anniversary.

It was then explained to the Meeting by the PRESIDENT, that in consequence of the fourth Monday in May (the usual day for the Anniversary) falling this year on Whit-Monday, a Bank Holiday, the day of meeting had been necessarily changed to the fourth Monday in June.

The Rev. HORACE WALLER and ROBERT CUST, Esq., were nominated by the President as Scrutineers of the Ballot, for President and Council for 1874-5.

ELECTIONS.—*Henry Ansell, Esq.; Lieutenant Frederic Clowes; Eduyn Dawes, Esq.; A. A. Hayes, jun., Esq.; John Holt, Esq.; Hon. J. P. Locke King; Rev. James Long; H. Mann, Esq.; H. A. Ridgway, Esq.; Francis Saunders, Esq.; James Spicer, Esq.; Thomas Thompson, Esq.; Walter Frederick Walker, Esq.; Captain James Waterhouse (Bombay Staff Corps).*

The Report of the Council was then read by Mr. R. H. MAJOR. Its adoption by the Meeting was moved by M. P. EDGEWORTH, Esq., seconded by G. W. RUSDEN, Esq., and carried unanimously.

ROYAL MEDALS.

The FOUNDER'S Gold Medal for the promotion of Geographical Science and Discovery was awarded this year to Dr. Georg VOL. XVIII.

Schweinfürth, for his explorations in Africa during many years; for his determination of the south-western limits of the basin of the Nile, and discovery of the River Uelle, in a new region beyond those limits; and for his admirable work, 'The Heart of Africa,' in which he has recorded the valuable results of his travels. The VICTORIA, or PATRON's Gold Medal, was awarded to Colonel P. Egerton Warburton, for his successful journey across the previously unknown western interior of Australia, from Alice Springs, on the line of Overland Telegraph, to the west coast, near De Grey River.

In the absence of the medallists, His Excellency Count Münster, German Ambassador, attended to receive the medal on behalf of Dr. Schweinfürth, and J. Bateman, Esq., on behalf of Colonel Warburton.

Addressing Count Münster, the PRESIDENT said:—

"In handing this medal to your Excellency to be conveyed to your countryman, Dr. Georg Schweinfürth, who is expected soon to return from a new journey he has undertaken in the interior of Northern Africa, I have but little need to mention the services this distinguished traveller has rendered to Geographical Science—services which the Council of this Society have felt it their duty thus publicly to acknowledge. The work describing his journey, which has been published by Schweinfürth, and translated into the English language, has been so widely read that few persons with a taste for geography and the allied subjects can have failed to read and admire it. Trained by a previous experience of three years in African travel, in Nubia, Dr. Schweinfürth started on his longer journey in 1868, with the fixed purpose of exploring that portion of the region of the Upper Nile which is watered by the tributaries of the Bahri Ghazal, and which had been previously visited by Petterick, von Heuglin, Antinori, Piaggia, Mademoiselle Tinné, and others. Trusting himself, as a solitary European, in the hands of an armed party of ivory merchants, he penetrated with them to their most distant stations, beyond the country of the once mysterious Nyam-Nyams, and across the watershed of the Nile. Although unprovided with instruments for astronomical observations, he plotted his routes on the basis of calculated paces and compass bearings, and with such accuracy that he was enabled to furnish material for a good map of the whole country he traversed; an accuracy which he tested by a long journey undertaken for the sole purpose of verifying his work by connecting it with a fixed position on the

route of Petherick. But it is not merely for his topographical labours that the Council deem him eminently worthy of the distinction of a Royal Medal. His book teems with observations on the physical geography, ethnology, climate, botany, and resources of that remote region; and so graphically has he portrayed its various aspects, that we seem, in his pages, to obtain a clear idea of the interior of Equatorial Africa.

“With these remarks permit me, your Excellency, to deliver this medal into your hands.”

His Excellency Count Münster briefly replied:—He felt proud and grateful that the Society had conferred the greatest honour in its power to bestow, on one of his countrymen, and as soon as he should learn the arrival of Dr. Schweinfürth from the new journey in Africa, which he had undertaken since the publication of the work alluded to by the President, he would lose no time in transmitting it into his hands. He (Count Münster) was gratified to think that his countrymen worked together with the Royal Geographical Society for the great objects of science and civilization, and was proud of the honour of himself belonging, as a member, to the Royal Geographical Society.

Next addressing Mr. J. Bateman, who attended to receive the Victoria or Patron’s Medal on behalf of Colonel Egerton Warburton, now in Australia, the President thus spoke:—

“The Council of the Royal Geographical Society have decreed one of the Royal Medals of the year to your relative, Colonel Egerton Warburton, in testimony of their admiration of the ability and daring he has displayed in undertaking and carrying to a successful issue one of the most difficult and hazardous explorations of recent times, across a previously unknown part of Australia—a part which had baffled the attempts of several previous travellers. Starting from Alice’s Springs, near Central Mount Stuart, on the line of Overland Telegraph, on the 15th of April, 1873, he reached, after eight months’ march—the latter portion of which was through an arid region where they were supported by the meat of their slaughtered camels, and finally narrowly escaped death from starvation—the frontier settlements on the De Grey River at the end of December, and Roebourne, in Nickol Bay, early in last January. Thus nearly 1000 miles of entirely new country have been traversed, and although no detailed account of the Expedition has yet been received in this country, the Council have full confidence that a large amount of

accurate geographical information will be added by Colonel Warburton, as the fruits of his Expedition, to the common stock of knowledge. During the twenty years he has been a resident in the colony he has been repeatedly engaged in the work of geographical exploration, and in the years 1865-1866 distinguished himself by his journeys in the basin of Lake Eyre, his Report of which, with a map, was published by the Colonial Government. Although so large a portion of the region traversed in his last Expedition proved so trying to the party and so destitute of resources, no part of it was utterly destitute of vegetation, and there can be no doubt that his journey will lead to important practical results. Indeed, his safe arrival in Adelaide was celebrated on the 16th of April last by a banquet, at which 220 gentlemen, representatives of all the chief interests in the community, attended to give an enthusiastic welcome to the successful explorer. I am happy to learn from Colonel Mant, that Colonel Warburton was engaged, when he last heard from him, in preparing his Journal, and that his son, who accompanied him in his journey, is constructing a map of the region traversed, both which will be sent to England for publication. In placing this Medal in your hands, for transmission to your relative, I trust that you will express to him the sympathy of myself and colleagues of the Council of this Society for the privations he has suffered, and our wishes for his future welfare."

Mr. BATEMAN, in acknowledging the gift, said that he regretted that Colonel Warburton could not himself be present to return thanks. He was sure that if anything could repay his relative for the arduous journey he had performed, and the very great sufferings he had endured, it would be the honour that the Royal Geographical Society had conferred upon him. It was hard to realize that in the centre of Western Australia an unexplored district existed, as large in area as Spain and Portugal together. All the attempts which had hitherto been made to traverse it had failed, in consequence of the extreme aridity of the country. Governor Eyre, in his well-known journey, was obliged to travel along the coast and subsist on shell-fish; and of the fourteen persons who started in the expedition under Colonel Warburton, only two remained capable of doing their duty. All the hardships, however, which the leader had undergone would be richly atoned for by the Gold Medal of the Royal Geographical Society.

## PUBLIC SCHOOLS PRIZE MEDALS.

MR. FRANCIS GALTON, F.R.S., Chairman of the Public Schools Prizes Committee, introduced the subject of the awards of the year in the following words:—

"The Society will learn with pleasure that their offer of four medals for annual competition among all the boys of our great public schools has again produced gratifying results. No less than 15 great public schools have sent competitors, and the boys who come first in our list are adjudged by the examiners to have well deserved their honours. This is the sixth year of our examinations, and consequently 24 medals have been won since their commencement, which, together with the number of those 'honourably mentioned,' testifies to perhaps 100 public-schoolboys having been induced by us to make a serious and successful study of geography. The authorities of public schools are apt to complain of the difficulty of obtaining good teachers in natural science: we, at all events, are doing our part towards preparing material whence future teachers may be selected. We may also take credit to ourselves for having already raised the standard of geographical teaching in many schools. It has occurred more than once that candidates have been found ill prepared: we represented the defect to the head masters, who turned their attention to remedying it, and their boys in subsequent years have distinguished themselves. Lastly, we have had the continued good fortune to secure geographers of the highest rank for our examiners. This was a means we had in view from the first, of improving the quality of geographical examinations and incidentally of geographical teaching."

The PRESIDENT then presented medals as follows:—

PHYSICAL GEOGRAPHY (Examiner, Professor A. C. RAMSAY, LL.D., &c.)

*Gold Medal.*—Louis Weston, City of London School.

*Bronze Medal.*—Francis Charles Montague, University College School.

POLITICAL GEOGRAPHY (Examiner, the Rev. Canon RAWLINSON, M.A.)

*Gold Medal.*—William Harry Turton, Clifton College, Bristol.

*Bronze Medal.*—Lionel Jacob, City of London School.

The Rev. Mr. Durham, of the City of London School, and Mr. W. W. Magee, of University College School, also attended.

The Hon. G. C. BRODRICK then announced that the special sub-

ject for the examination next year would be China; and, in doing so, he expressed a hope that the Society would be as fortunate as it had hitherto been in securing the services of eminent examiners in that subject. As Mr. Galton had said, that had been one of the objects the Society had had in view, and hitherto they had been very successful. In 1872, South America being the special subject, the services of Mr. Bates were secured, who has thrown so much light upon that region by his own researches. In 1873, the subject being Central Asia, Sir Henry Rawlinson was the examiner in Political Geography, and Dr. Hooker in Physical Geography. At the last examination, when the subject was the British Isles, Professor Ramsay was the examiner in Physical Geography. Of course, China could not be compared in historical interest with the British Isles, nor could the competing candidates next year have the advantage of such admirable text-books on physical and political geography as those which the candidates for the present year had had. At the same time the physical geography of China was of very great interest, and perhaps there was no country so important about which the general public knew so little. A popular impression still prevailed, though it certainly could not be shared by the Fellows of the Society, that China is not many times larger than Great Britain, but is most densely peopled; the fact really being that it is at least eighteen times as large as Great Britain, and is not so densely peopled as Great Britain. Yet China is, after all, but six weeks distant from England; and in these days, when a journey round the world by way of China can be accomplished in 90 days, it is not too much to hope that some of those who are led to study the geography of that country for the purpose of next year's examinations, may hereafter visit it themselves. Those who competed for the prizes would not only find themselves amply rewarded by the interest of the subject itself, and by the commercial utility of geographical knowledge in these days, but also by its value in University examinations. A definite and honourable place had been assigned to geography in the new system of examinations of schools which had been established by the Universities; and the Council of the Society had lately, through their President, addressed a letter to the Vice-Chancellors of the Universities of Oxford and Cambridge, pointing out the claims of geographical science to due recognition in any future redistribution of University revenues, and suggesting that there ought to be a Professorship of geography in each University, and that it might even be possible to found

travelling Fellowships for the encouragement of original research in geography.

The Ballot then took place, and was declared by the Scrutineers to have resulted in the election of the following gentlemen as President and Council for the ensuing year (the names in Italics being those of the New Members, or those who change office):—  
*President*: Major-General Sir Henry C. Rawlinson, K.C.B. *Vice-Presidents*: Sir Rutherford Alcock, K.C.B., &c.; Admiral Sir George Back, D.C.L.; Vice-Admiral R. Collinson, C.B.; Right Hon. Sir H. Bartle Frere, K.C.B., G.C.S.I., &c. *Trustees*: Lord Houghton, D.C.L., F.R.S.; Sir Walter C. Trevelyan, Bart. *Secretaries*: Clements R. Markham, Esq., C.B., F.S.A.; R. H. Major, Esq., F.S.A. *Foreign Secretary*: Lord Arthur Russell, M.P. *Councillors*: Sir Samuel White Baker, F.R.S.; Hon. George C. Brodrick; Sir George Campbell, K.C.S.I., &c.; Lord Cottesloe; Captain F. J. O. Evans, R.N., C.B.; A. G. Findlay, Esq.; James Ferguson, Esq., F.R.S.; Vice-Admiral Sir William H. Hall, K.C.B.; Major-General Sir Frederic J. Goldsmid, K.C.S.I.; M. E. Grant-Duff, Esq., M.P.; Lieut.-Col. James A. Grant, C.B., C.S.I.; John Murray, Esq.; Sir Charles Nicholson, Bart., D.C.L.; Vice-Admiral E. Ommanney, C.B., F.R.S.; General C. P. Rigby; Marquis of Lorne; H. Danby Seymour, Esq.; S. W. Silver, Esq.; Warington Smyth, Esq., F.R.S.; Sir Harry C. Verney, Bart.; Major C. W. Wilson, R.E. *Treasurer*: Reginald T. Cocks, Esq.

After the Ballot the PRESIDENT read the Annual Address on the progress of Geography, and, at its conclusion,

Sir H. RAWLINSON said he should be sorry for the meeting to separate without expressing, in a marked manner, their respect and gratitude to Sir Bartle Frere, on this the last occasion of his presiding over their proceedings. It was a matter of much regret to himself (Sir Henry), personally, as it must be to all the Fellows of the Society, that the Council had not been able to persuade Sir Bartle to retain, for a longer period, the office which he had so worthily filled during the past year. The report of the Council showed that during that year the Society had increased in a marked manner both in numbers and reputation; and for that exceptional prosperity they were no doubt greatly indebted to the high personal character of Sir Bartle Frere, united with his very special qualifications for the office. He had always been remarkable for combining those qualities of heart and head which enabled him to command the admiration and to enlist the sympathies of his fellow-

men. Had he continued to fill the chair, undoubtedly the same prosperity would have attended the Society in the future. As his successor, he (Sir Henry) felt very much the increased responsibilities which devolved upon him. They could not always expect the same great accession of new members, nor that new objects of interest would command the public attention as did the last day of the heroic Livingstone; but no doubt questions of importance would arise, and in devoting himself to the charge of the interests of the Society, he should take for his example the conduct and labours of his predecessor.

Sir Henry then proposed a vote of thanks to the retiring Members of the Council, and to the Auditors. He would wish to include this vote also the Staff, for he believed there was no Society in the Metropolis better served by its Council and Staff than the Royal Geographical Society. No President, whatever might be his qualifications, would be able to conduct the business of the Society satisfactorily, or at least so admirably as it had been conducted without the cordial co-operation of the Staff.

The retiring PRESIDENT, in acknowledging the vote, said, that what he had observed, Sir Henry Rawlinson must have drawn more upon his ancient friendship than upon anything which he (Sir Bart) had been able to effect for the Society. Had he been remaining an inhabitant of London, he should have been very glad to have done anything he could further to serve the Society; but the work the Society had grown to such dimensions, and required such constant attention, that without continual residence in London it was quite impossible to do justice to it. His work had been materially lightened by the cordial co-operation of the Staff, who had rendered it in every sense a work of as much pleasure as it was of responsibility. With such a successor as Sir Henry Rawlinson, he felt certain that there would be no diminution in the prosperity of the Society; and as long as he belonged to it, exertion should be wanting on his part to second the efforts of one who would so worthily follow in the steps of the great founder of the Society (as he might call him), who laid down the principles upon which he himself had endeavoured to walk in all he had done in the management of the Society; and he looked forward to Sir Henry's tenure of office as likely to be the most prosperous period of the Society's existence.

Before the conclusion of the proceedings, the President announced

that the Council had that day unanimously decided that medals should be given to the servants of Dr. Livingstone who had come to England, and that a special silver medal should be struck, to be given, as a mark of approbation of their fidelity and courage, to all who accompanied the Doctor in his last great expedition.

The Rev. Horace Waller then led up to the President Chumah and Susi, two of Dr. Livingstone's followers, to each of whom the President gave a bronze medal.

Speaking on behalf of the two recipients, the Rev. Mr. Waller thanked the Society for the gift. These faithful companions of Livingstone were able, he said, to give an intelligible account of every river and mountain and village in the regions they had passed through; and such aid as they could give was of the first importance to Mr. Livingstone in preparing the work on which he was now engaged.

*Postscript.*—Since the preceding was in type, the following letter, in acknowledgment of the Royal Medal, was received from Dr. Schweinfürth:—

"GENTLEMEN,

"Berlin, July 18, 1874.

"On the 17th instant, I received, through the medium of Count Münster and of our Ministry of Public Instruction, the great medal which you have awarded me.

"On receiving this rare, high, and unique mark of distinction, I am moved by feelings of joy and gratitude which will ever accompany me to the end of my life. Allow me herewith to give expression to those feelings.

"When, years ago, I set out to begin my lonely wanderings, I little expected that fortune would ever favour me with this extraordinary honour, which, emanating from the highest authority in Great Britain, is awarded by the most impartial and the most competent judges in that great kingdom; and that a corporation, to whom the opinion of the whole world assigns the supreme direction of all labour in the field of geographical discovery, would act as umpire on that occasion.

"But that reward, far above my feeble deserts, which a kind Providence has cast into my lap, shall incite me to labour further at the solution of those problems which science indicates to me.

There cannot be a more enduring encouragement to that end, than the one you have awarded.

"All my efforts shall henceforth be directed to make me more worthy of the distinction I have been honoured with, and while I unite the warmest wishes for the welfare of the Royal Geographical Society with this determination, I preserve my medal as a token of your gratifying goodwill.

"Accept, honoured gentlemen, my thankful and deeply devoted greetings.

*"To the President and Council of the Royal  
Geographical Society of London."*

## A D D R E S S

TO

## THE ROYAL GEOGRAPHICAL SOCIETY.

*Delivered at the Anniversary Meeting on the 22nd June, 1874.*BY THE RIGHT HON. SIR H. BARTLE FRERE, K.C.B., G.C.S.I.,  
D.C.L., LL.D., ETC., PRESIDENT.

GENTLEMEN,

In fulfilling my duty as your President, of laying before you a review of the Geographical events of the past year, I may begin by congratulating you on the continued prosperity and activity of the Society. By the Council Report which has just been read you have been informed that no fewer than 342 New Members, besides 9 Honorary Corresponding Associates, have been elected during the year. The total number now on our rolls is 2809 Ordinary, and 76 Honorary Corresponding Members. Accompanying this increase in numbers, and its concurrent increase of revenue, we may hope that there has been an increased activity and usefulness; and I am convinced that a Society like ours, fulfilling, as it does, a public want, may look forward to a career of prosperity proportioned to the general growth of the nation.

The improved punctuality in the publication of our 'Journal' and 'Proceedings,' so justly noticed last year by my predecessor, as reflecting so much credit on our excellent Secretaries, and especially on Mr. H. W. Bates, on whom so much of the labour falls, has been carried still further during the past season, and leaves little on this score to be desired.

## OBITUARY.

DR. LIVINGSTONE.—The great geographical event of the year has been, beyond all doubt, the ascertainment of the fate of Dr.

Livingstone, and the recovery, through the fidelity of his followers, of those full records of his last expedition which his son is now preparing for publication.

In an annual summary like the present, it is impossible to do more than briefly glance at the leading events of a life devoted with unflagging energy, and without rest or intermission, to labours having for their main object the elevation of the Negro races of Africa in the social and moral scale of humanity; but one incidental result of which has been to place Dr. Livingstone in the foremost rank of discoverers and geographical explorers of this or probably of any age.

David Livingstone was born at Blantyre in Scotland, on the 19th of March, 1813, of a race distinguished in Scottish annals for that staunch fidelity to their convictions and objects in life which was so characteristic of the great traveller. The family had been reduced in fortune during the political distractions which marked the last years of the Stuart dynasty, and his parents could give to David, their second son, little more than the inheritance of sterling domestic virtues and high principles, with such an excellent practical education as the local schools of Scotland have for generations past afforded.

The epitaph which he inscribed on his parents' resting-place at Hamilton, when, after his first return from Africa, the children laid their mother beside their father's grave, records, in his own simple and touching language, his sense of how much he owed to early home-training. It runs:—"1856. To show the resting-place of Neil Livingstone and Agnes Hunter; and to express the thankfulness to God of their children, John, David, Janet, Charles, and Agnes, for poor and pious parents."

Both parents appear to have enjoyed, in their own neighbourhood, a respect due to high character and active religious principle, which secured for them a degree of consideration far beyond what could have been expected from their worldly fortune; and it was from them, apparently, that David Livingstone early imbibed those strong yet catholic religious views, and that passionate desire to extend the blessings of Christian teaching and civilization to the poorest and the meanest of mankind, which formed the main-spring of his action in after life.

From his earliest youth he had been taught the duty and the power of self-reliance; and the first use he made of such liberty as was afforded him, by having to aid in working for his own live-

lihood, was to set himself to supplement his school education by the acquisition of every kind of knowledge which came within his reach. Gradually his inclinations and studies shaped themselves to what was needed to obtain at the Glasgow University such a degree as should enable him to offer himself for the ministry, and obtain an opportunity of working with any of the great Missionary Societies which devote their labours to the extension of Christianity in distant lands; and he obtained, under circumstances which greatly enhanced the difficulty of the acquisition, a very wide and thorough elementary knowledge of surgery and medicine, and of most divisions of natural science which bear on the medical profession, besides those branches of theology which form the University curriculum of divinity students intended for the ministry of the Established Church of Scotland. The energy with which he worked may be estimated from the fact that he gained his medical diploma at Glasgow without a farthing of aid from any one; saving sufficient from his hard-won earnings in summer, to support himself whilst attending medical and Greek classes at Glasgow during the winter. Indeed, all that belonged to his early life and training is of the utmost interest to the student of human nature and the lover of human progress; but it is impossible in such an address as the present to do more than indicate very briefly the main circumstances which formed and qualified the future great explorer.

We must, therefore, pass rapidly over the history of his joining the London Missionary Society, the disappointment of his hopes of being employed in China, the acquaintance with Dr. Moffat—then already a veteran African missionary—and his final resolve to join Moffat's Mission at Kuruman or New Latakoo—at that time far beyond the utmost boundary of civilized and settled European colonization at the Cape of Good Hope. He reached Africa in 1840, and thenceforward devoted his whole being to the improvement and elevation of the races of that continent. How he learned and laboured as a missionary, under the sagacious guidance of Dr. Moffat; how he there formed the domestic ties which lent such a human charm to the romance of his after-life; how he pondered the great questions whether Christianity or civilization should lead the way in the great work he saw before him, till he arrived at the conclusion that in these days, at all events, they cannot be separated, and they must march together; how the complex character of the great problems involved gradually unfolded itself to his meditations; how he finally realised the truth that the explorer and

traveller must precede, or at least accompany, either the missionary or trader; and how he resolved himself to be the pioneer—all this history we must leave to be unfolded by his biographer.

One of his first objects was to acquire a thorough command of the Sechuana language; one of very great power and copiousness, and spoken, with dialectic variations, over a large area of Southern Africa. In order to do this, he completely isolated himself for several months from all European society, and thus gained a clear insight into the language, habits, modes of thought, motives, and character of the African races. During this missionary period of his life he undertook seven journeys, each of not less than 600 miles; in one of which, in 1842, he was within 10 days' distance of Lake N'gami; but, probably, through being without any knowledge of the observations needful to a geographer, he gave no account of these travellings. His first attempt at publishing the result of his experiences seems to have been a paper which he sent in 1843 to Dr. Buckland, on the gradual desiccation of the countries he had traversed; but it is very uncertain whether this ever reached its destination, though the subject was well discussed at a later period.

His daring character could not remain long unknown. Kindred spirits were drawn around him, and travellers and sportsmen came from afar to consult him. Although a keen sportsman from boyhood, the heavy work of daily teaching was never neglected for self-enjoyment. At no time had he any sympathy with the mere slaughterer of game, and he seldom hunted except when it was necessary to provide for himself and those around him.

In 1843 he selected a beautiful valley called Mabotsa, between Kuruman and Kolobeng, in lat.  $25^{\circ} 14'$  S., as the site of his first separate missionary station. One circumstance may here be mentioned in illustration of the powers of endurance which must be assumed when speaking of him. In 1843, whilst trying to rid the village of an old man-eating lion, he was very nearly killed by the wounded and infuriated beast. For thirty years afterwards all his labours and adventures, entailing such exertion and fatigue, were undertaken with a limb so maimed that it was painful for him to raise a fowling-piece or in fact to place the left arm in any position above the level of the shoulder. At one period especially, when so much of his time was passed in navigating the "Pioneer" on the Zambezi, it was frequently noticed that the false joint in the arm made him powerless to climb up the

side of a ship: that this old fracture was eventually the sole means of identifying his remains is now a matter of world-wide interest.

Kolobeng, his second station, 270 miles north of Kuruman, to which he removed in 1847, is placed almost under the tropic of Cancer, and is consequently subject to the extreme dryness caused by a nearly vertical sun. But as it is elevated from 4000 to 6000-feet above the sea, its temperature is not excessive, and it is free from marsh malaria, and thus served for a tropical sanatorium. The territories around it, with their peculiar vegetation, supported so enormous an amount of animal life, that the reports given by travellers and sportsmen of the countless herds of game would be incredible, were they not fully confirmed by Dr. Livingstone and others. In scenes and circumstances so entirely at variance with those of his early life, and amid so fine a field for his powers of observation, the young missionary at once commenced to gather that knowledge which he found of the utmost value throughout his subsequent career, either as a stationary pastor or as the enterprising traveller.

As in the outset of his career the coincidence of the China war and the visit of Dr. Moffat to this country caused Dr. Livingstone's field of enterprise to be thrown in Southern Africa, so many influential circumstances concurred to change his career from that of the quiet but active missionary, which he followed with single aim and devotion for twelve years, to that of the bold and vigorous explorer, which he continued to his last hour. Some of these remarkable coincidences it may be well to notice. Previous to the opening and development of the Overland route between India and Europe, the furlough rules of the Indian army restricted officers during their terms of leave to the Cape; many of them made for the country in which Livingstone was stationed, on account of its salubrity; the abundance of game also attracted them, and many sportsmen and travellers came to him for advice and aid, among whom were several Associates of the Royal Geographical Society. In this way friendships were begun which ended only with his death, and generous aid was afforded him which first opened his way to wider views.

Again, the political troubles arising out of the Kaffir aggressions, and the hostility of a section of the Dutch community, occurred about the same period, and leading to the entire destruction of his missionary station, induced him to change the scene of his operations to unexplored regions further north. At the same juncture, again, Arab traders made their first appearance on the Western Zambesi

from Zanzibar : had they come a year or two earlier they would have bought up and removed the ivory, &c., which Dr. Livingstone was able to utilize for crossing and recrossing Africa with his faithful Makololo. The gigantic success of these journeys at once placed him beyond the reach of adverse external circumstances as to his future progress, and thus, in the second half of his African career, he was enabled to outdo all travellers who had preceded him in any age.

Undoubtedly his own great powers, natural and acquired, were one great element in his success. The qualifications necessary to constitute a complete traveller are so many and various, that they are seldom found in any one man ; but Livingstone appeared to possess them all in a most exalted degree. His personal coolness and bravery, undisturbed and undaunted in any emergency, his wonderful tenacity of purpose, his gentleness and yet firmness in dealing with the native Africans, his self-negation and power of endurance, his iron frame and its capacity of resistance to all bad climatic influences, all these greatly contributed to success ; whilst the wide and extended view he had of the duties of his sacred calling, gave to his character an elevation and power far beyond what the highest mental or physical gifts could have commanded.

During the sojourn at Kolobeng he first saw slavery under that revolting aspect which roused every impulse of his generous nature into permanent antagonism.

The Dutch Boers around his mission station were perpetrating atrocities on the helpless tribes, which excited his greatest indignation : kidnapping, murder, and rapine were every-day occurrences in the neighbourhood.

His denunciation of these villanies was so determined that ultimately Livingstone found himself the centre point of an irritation and popular persecution which forboded the most serious consequences. Space will not allow us to enter very deeply into these first records of his energy ; but they are by no means the least interesting episodes, and they go far to show the unchanging nature of his plans through life.

" It is difficult," we find him writing, " for a person in a civilised country to conceive that any body of men possessing the common attributes of humanity (and these Boers are by no means destitute of the better feelings of our nature) should, with one accord, set out, after loading their own wives and children with caresses, and proceed to shoot down in cold blood men and women, of a different

" colour, it is true, but possessed of domestic feelings and affections equal to their own. I saw and conversed with children in Boers' houses who had, by their own and their master's account, been captured; and in several instances I traced the parents of these unfortunates, though the plan approved amongst the Burghers is to take children so young that they soon forget their parents, and their native language also."

Livingstone became intolerable in the eyes of these men, but, although tried severely, he was not found wanting. He was accused of wishing to raise the native tribes to a higher sense of self-regard, and of a desire to open up the country in which they dwelt, and as a consequence, in 1852 we find his mission station destroyed whilst he was absent, his medicines scattered, his furniture and clothing carried off and sold at auction by the Boers. "They resolved to shut up the interior, and I determined to open the country; and we shall see who have been most successful in resolution, they or I." When we look back on his efforts, what a purpose lay wrapped in these iron-willed utterances at Kolobeng!

Livingstone's first important journey of discovery was commenced on June 1, 1849. His object was to cross the dreaded Kalahari desert and reach the reported Lake N'gami. He had communicated his plans to several friends that he had attached to his humble home at Kolobeng, and with their generous aid he was enabled to carry them out. These were Captain (now General Sir) Thomas Steele, F.R.G.S., then aide-de-camp to the Marquis of Tweeddale, at Madras, Mr. William Cotton Osswell, and Mr. Mungo Murray. In company with the last two-named gentlemen, the lake was reached on August 1st, but the season was too far advanced for them to reach Sebituane. Captain Steele sent the account of this important journey to the Royal Geographical Society, and thus Dr. Livingstone's name and powers were at once placed well before the world by Sir Roderick Murchison. It was at once decided by the Royal Geographical Society to take cognisance of his intrepid feat, and a chronometer-watch was awarded in 1849 to "the Rev. David Livingstone, of Kolobeng, for his successful explorations in South Africa." This was his first geographical communication through our Society, when it was rising again into importance under the influence of his most earnest and best friend, Sir Roderick. Two years previous the Society, it may be remembered by our older Fellows, was in too languishing a condition to have afforded him much aid; but at the time that his first communication reached us,

in February, 1850, it was under the vigorous guidance of Admiral Smyth, Sir R. Murchison, and Dr. Norton Shaw : his worth was at once fully appreciated, and that lasting friendship began which was a bright feature in the lives of our late much-loved President and the great traveller. He again started for the lake in the following year ; but returned without attaining his object of meeting with Sebituane. Nothing daunted, in 1851 he again started with his firm friend, Mr. Oswell, taking with him Mrs. Livingstone and his children ; and they were rewarded by the discovery of the Great Zambesi River, at the end of June, 1851, in the centre of the continent, and not far from one of the wonders of the world, the unequalled Victoria Falls. At this time he seems to have formed the determination of opening a highway for commerce and Christianity by means of the great rivers to the East and West coasts ; and proposed, accordingly, to Mr. Oswell to trace a route to the Eastern sea-board ; but this was not carried out, and Livingstone with his family returned to Kolobeng.

At Linyante, on the River Chobe, he met Sebituane, a chief of the Makololo, a man of enlarged views, most earnestly attached to him, and who had a very marked influence on his future career. But here Livingstone was met by a severe and unlooked for misfortune. He and Mr. Oswell had hardly time to congratulate themselves on having reached Sebituane (whom he describes as "decidedly the best specimen of a native chief he ever saw"), when the chief was carried off by sudden illness.

It is somewhat singular that Dr. Livingstone should have propounded the same view of opening up Inner Africa, that was proposed in 1793 by Dr. de Lacerda, each supposing that the Great Zambesi would form nearly a continuous water-communication between the East and West coasts.

On the destruction of his house and property, and the carrying into slavery of his 200 school-children at Kolobeng, Dr. Livingstone determined on seeking an entirely new field for his missionary work. He first accompanied his wife and children on the long journey to Cape Town, crossing the entire colony with perfect safety in the midst of an inglorious but very costly Caffre war. This was his first appearance in civilized life for eleven years. He reached the Cape in April, 1852. During his sojourn here he was indebted to his firm friend (Sir) Thomas Maclear, then Astronomer Royal to the Colony, for much useful instruction in astronomical observation. Having seen his family safely embarked for England, he

started on his return journey in June, 1852, reaching Kuruman, which place he left for his next journey on November 20th, and Kolobeng on January 15th, 1853, arriving at Linyante, the capital of the Makololo, on May 23rd, and was most favourably received by the young chief Sekeletu, the successor of his late friend Sebituane.

We now mark a most significant era, not only in the life of this undaunted man, but in those busy schemes which, as they had for their sole object the welfare of the tribes around him, were liable to continual change of front as new and unlooked-for circumstances arose.

In a word, to the dismay of Livingstone, the slave trade had made its way to Linyante, Sebituane's town, and was already bearing its baneful fruit amongst the Makololo people of his adoption. Some traders had reached the chief's quarters, and, in exchange for a few much-coveted guns, they carried away hundreds of captives. How was this evil to be arrested? One plan seemed to commend itself. If the natives could be shown a way to the outer world, so as to find a market for their ivory and produce, they might yet be saved.

Thus it is that we see him for thirty years eagerly looking about for a natural highway for Commerce. River after river is traced from source to sea. It is always the same hope, the continually deepening conviction; and he still trusts on that the water-ways of Eastern and Central Africa may prove sufficiently vast, continuous and deep for the cherished scheme of extended commerce and civilization "to come out all right at last."

Nothing is more striking, in his narrative of this first gigantic enterprise, than the utter disproportion of his outfit to the task he set himself. It is in such marked contrast to later experience, that it is all but incredible that he was enabled, with but a comparatively few shillings' worth of European necessaries, to lead his followers to a successful termination of their work. It is true that in going to São Paulo de Loanda in search of a market for the ivory which was all but worthless to Sekeletu, he acted in some degree as the agent of that chief, and was most materially aided by his influence and commands; but he mainly depended on his gun for support for himself and his twenty-seven followers, who volunteered at Linyante for the time his journey occupied, from their departure on November 11th, 1853, until their arrival at Loanda, on May 21st, 1854, Dr. Livingstone himself being nearly worn out by fatigue and illness. Through the kindness and attention of our

Associate, Mr. Edmund Gabriel, he soon recovered, and with many presents he, accompanied by his faithful attendants, set out on his return to Sekeletu on September 20th, 1854, and reached Sesheke in the following September.

The route from the centre of Africa to the West Coast not being found so advantageous for trade as was hoped for, Dr. Livingstone at once made a resolution to try the eastern road, to the Portuguese settlements at the mouth of the Zambesi. Again furnished with ivory by Sekeletu, and accompanied by his volunteers, he left Linyante on November 3rd, and, after visiting the Victoria Falls of the Zambesi, he finally reached Quilimane, at its mouth, on May 26th, 1856, which was within a few days of four years after he left Cape Town.

He thus finished his famous journey across the continent. These travels had now excited the interest of the whole world. Such honours as it was in our power to bestow were quickly his, and the Patron's Medal was awarded him in 1855. We, as geographers, had an unbounded source of satisfaction in thus signifying our appreciation of his labours in threading the course of the River Zambesi. Already his careful observations had been forwarded to the Astronomical Department at the Cape of Good Hope, there to undergo the most searching scrutiny. How can one better describe the results than by repeating the announcement made by your then President, Lord Ellesmere, to the members of the Royal Geographical Society? In speaking of the scrutiny of Livingstone's notes, which had been undertaken by Sir Thomas Maclear and Sir J. Herschel, he exclaimed, "I believe I may say that there is more sound geography in the sheet of foolscap which contains them than in many volumes of much more pretension."

He left Quilimane on July 12th, reached the Mauritius on August 12th, and finally arrived in his native country on December 12th, for the first time, after an absence of more than sixteen years. Three days after, on December 15th, at a Special Meeting of the Society, he received such an enthusiastic welcome from his numerous friends at a most crowded assembly as is accorded to few.

The next few months were occupied with what, to him, was an arduous task—writing the account of his 'Missionary Travels.' This was done at the hospitable seat of his former friend in Africa, Mr. Webb, of Newstead Abbey.

It has been said by some who afterwards visited the Zambesi

districts, that it is almost worth a journey thither to notice the painstaking accuracy of his descriptions. Exaggeration in any shape appears throughout his life to have been so utterly foreign to his nature, that the only corrections his first observations required were usually additions to his first moderate estimate of distances travelled, of mountain heights, or breadth of rivers.

His 'Missionary Travels' met with the favour they deserved. Mr. Murray announced that 30,000 copies were sold soon after publication, besides 15,000 copies subsequently in a popular edition; and Dr. Livingstone's speeches, which will be found faithfully recorded in the 'Proceedings' of our Society, were always listened to with profound attention and the deepest interest.

We now pass to that which may be called his second series of explorations. Livingstone at this time solicited the aid of his countrymen. The Government placed at his disposal the materials which quickly formed "the Zambesi Expedition." At the grand farewell banquet given to him under the auspices of our late lamented President, Sir Roderick Murchison, on the 13th February, 1858, at which 350 guests assembled, many of the most distinguished statesmen and philosophers of the day were present, and testified by their speeches to the admiration and respect which he had earned from all classes of his countrymen.

The Expedition started for the Zambesi on the 10th March, 1858. Captain Bedingfield, R.N., Charles Livingstone (whose death we so recently deplored), Dr. Kirk, Dr. Meller, Richard Thornton, and Thomas Baines, gathered round him to share his enterprise.

Looking back upon the exploits of this adventurous little band, we find a continuous record of hard work, and each member of the Expedition pervaded by the same indomitable courage. The first act was to tramp on foot to the very heart of the continent and to revisit Sekeletu, the Chief of the Makololo, whose tribe was even then tottering to its fall.

From a geographical point of view, we note discoveries at this period of great importance. As in other places, the Portuguese were penned into their settlements by the angry disposition of the Zambesi and Shiré tribes; indeed, nothing at all was known of the sources of the rivers flowing through their territories.

Livingstone at once set about tracing the Shiré to its source, and in September, 1860, he found it flowing from the beautiful Lake Nyassa—an inland sea, which, if we mistake not, will before long be turned to great account in founding substantial relations with

the natives. Lake Shirwa was also discovered on this journey; but hardly second in importance was the newly-acquired knowledge that a high and comparatively healthy region lies stretched from the left bank of the Shiré for hundreds of miles.

If we trace an approach to enthusiasm in Livingstone's descriptions anywhere, it is when we find him detailing the industries of the Manganja and Ajawas on these hills, or describing their iron-forges, their cotton-fields and cloth-looms, their pottery, and the beauty of the fibres with which they make their nets: if we detect intense indignation, it is when he finds that the slave-traders, subsidised by the Portuguese authorities, invaded this fair region the instant his back was turned.

It was mainly owing to his representations that Bishop Mackenzie left England in 1860 to work on the lines laid down by Livingstone: the aim being to civilise and Christianise the natives. Under such a self-denying leader, with clergy, laymen, and mechanics attached to it,—with uncompromising opposition to slave trading as its *raison d'être*,—the best hopes followed the "Universities Mission."

To his great sorrow, the country Livingstone had fixed upon for the site of the mission station was hardly tenable at this time. The torrent of slavery had burst in upon the land. Both Livingstone and Mackenzie joined forces in attempting to stay the devastation occasioned by the slave wars. The liberation of large gangs of slaves and the terror of the English name in the slavers' camps were amongst the most marked features of this chapter in his life, and never did Livingstone's character shine out in truer colours than when leading his little band through the burning villages of the paralysed Manganja, to free their wives and children from the chains and yokes of the slave-drivers. The example was not lost, for we read in his last letters that, many years after, when hundreds of miles away from the Shiré highlands, a panic seized certain Arab slave-traders, who got word that he, the liberator of slaves, was in the vicinity. Nor must we omit a yet more interesting fact. On one of these occasions, a lad was freed by his kindly hand not far from Lake Shirwa: for three years the boy lived with those who survived Mackenzie; for eight long hazardous years he was the faithful servant of his liberator, and, when the spirit fled from that iron frame at last, it was Chumah, the liberated slave-boy of the Shiré highlands, that led from Lobisa to Zanzibar those men who bore their dead master's body, and to whom we are

so much indebted for the safety of the Doctor's journals and writings.

During the year 1862 Livingstone was destined to suffer the terrible loss of his wife. Mrs. Livingstone went to the Zambesi to join her husband in his work, but in three weeks she succumbed to a desperate attack of fever, which baffled all the skill of the three medical men who attended her at Shupanga.

The Zambesi Expedition lasted for five years. After Livingstone's recall in 1863, how earnestly do we find him denouncing the villainy of Portuguese and Arab slave-traders! The difficulty—which was always to him a very great and real one—of facing a large audience used to vanish when pity stirred him to plead the cause of the harried tribes he had visited: how deeply the old malady of Africa had become his care let the chapters tell, which are devoted to the subject in his second book, called '*The Zambesi and its Tributaries*'.

Few will forget the enthusiastic reception accorded to Dr. Livingstone when he appeared in the Geographical Section of the British Association at Bath, in the autumn of 1864; but his short, and his second and final sojourn amongst us was mainly taken up in compiling the work which we have mentioned.

Space will not allow us to particularize the results of the Zambesi Expedition, but one fact must be noticed.

The testimony of those who witnessed the devastation of the slave trade, and who personally probed all its foul ramifications on the spot, has since borne ample fruit. Knowing as we do the extreme difficulty there has been to arouse this and other countries to the fact of the enormous development of the East African slave trade of late years, we may almost doubt if anything short of this period of trial and adventure could have opened the eyes of Europe to the true state of the case, but it was not till long afterwards that the evidence then collected moved the country to further action. It was the publication of further letters from Livingstone, written during his last journey, and detailing the still existing horrors of the slave traffic, which again directed attention to the revelations of '*The Zambesi and its Tributaries*', and three years ago led to the appointment of a select Parliamentary Committee of Inquiry. Many of his old companions were then called on to testify to what they had seen during the Zambesi Expedition, and the national conscience was at last awakened to the truths which had been put before the public many years before. Humanly speaking, Living-

stone, and Livingstone alone, has been the means of awakening public interest in this question. His clear, explicit statements take the place of all the loose facts too often ventured on by hearsay philanthropists. He saw for himself, he attracted others to see, and he infused all his own spirit of indignation into his fellow-witnesses of these crimes.

We have now arrived at the period of his last travels. The Zambezi Expedition had not answered his expectations. The thwarting policy of the Portuguese, the ravages of the slave trade, and the unfavourable dimensions of the "Pioneer" for river exploration defeated his purpose; and soon after he returned home, he felt a strong desire once more to explore as he had done in earlier days.

Determined to follow up the suggestions of our late President, Sir Roderick Murchison, Livingstone left us in August, 1865, "to define the true watershed of Inner Southern Africa." He spent the winter 1865-6 in Bombay and in Zanzibar, organizing his new Expedition. How he plunged into the inner depths of the unknown regions, lying between the coast and lakes Tanganyika and Nyassa, we know from the few waifs and strays of correspondence which escaped the vigilance of slave-traders, who were too sagaciously aware of the real consequences of his presence amongst them.

Ere we next assemble in Anniversary Meeting, the geographers of every nation will have before them the full results of this last and most important of his journeys; meantime, let it suffice to say that he entered East Africa at Mikindany Bay, near the mouth of the Rovuma in April, 1866; travelled thence to the eastern shore of Lake Nyassa; afterwards doubling its southern extremity, and proceeding northerly over the Lobisa highlands to the Cazembe and to Ujiji on Lake Tanganyika, discovering, in his way, the great Lake Bangweolo, and the magnificent river, the Lualaba. For many months lost to the outer world, he was successfully searched for, found, and succoured by Mr. H. M. Stanley, who finally left him in the month of March, 1872, after which (in August) he resumed his explorations, and, near the shores of Lake Bangweolo, died on the 4th of May, 1873. His remains were preserved by his negro attendants, and carried, together with his journals and other property, during an eight months' march, to Zanzibar, whence they were brought to England, arriving on the 15th of April; on which day they were formally identified at the house of this Society by the eminent surgeon and Livingstone's former friend, Sir W. Fergusson.

Thanks to the indomitable energy of this extraordinary man, and thanks, too, to those who, by contact with him, felt their own natures raised to deeds of faithfulness and heroism, David Livingstone's journals were not only kept with scrupulous care to within a few days of his death, but brought hither by his negro followers with a devotion, which, whilst it has excited the admiration of every civilized nation, has perhaps done more than any individual act on record to raise the black races in the estimation of the world. Let us never forget what has been done for geography by the faithful band who restored to us all that it was in their power to bring of our lost friend, and who rescued his priceless writings and maps from destruction. The remains of Livingstone were accompanied to this country by one of these faithful negro attendants, Jacob Wainwright, who witnessed their interment in Westminster Abbey, on the 18th April last under circumstances which none of us who witnessed the ceremony are ever likely to forget. His grave has since been visited by two of his attendants, Chumah and Susi, who had served him yet longer and with equal fidelity, and who have been brought to England since the funeral.

Ages may elapse before the full measure of his services to Africa can be accurately measured, for we may hope that by his lifelong labours a new era will be opened to all the Negro races of that continent, and no man can foresee the ultimate consequences of their enfranchisement. We are in a better position for judging of the great value of his services to geographical science. As a mere explorer he trod some 29,000 miles of African soil, and laid open nearly one million square miles of new country, equal to one-fourth the area of Europe.

So far back as the year 1859, your President, Lord Ellesmere, pointed to the rapidly filling blanks upon the map of Africa, and, as he gave praise and honour to Livingstone, he bade his fellows look on his work that they might read the man. But these facts give a very imperfect idea of the geographical results of his labours; for not only were his own observations singularly numerous and accurate, but to his example must be attributed much of the general impulse given to African exploration by others in this generation.

As a whole, the work of his life will surely be held up in ages to come as one of singular nobleness of design, and of unflinching energy and self-sacrifice in execution. It will be long ere any one man will be able to open so large an extent of unknown land

to civilized mankind. Yet longer, perhaps, ere we find a brighter example of a life of such continued and useful self-devotion to a noble cause.

CHARLES LIVINGSTONE, the brother, and for some time the co-adjutor of Dr. Livingstone, was born at Blantyre, Scotland, February 28, 1821. He acquired the best education afforded by the schools of Blantyre and Bothwell, and like his elder brothers, often gratified his intense love of nature by long rambles with them, searching out new and interesting objects. He was afterwards employed in a lace-manufacturing warehouse in Hamilton, and on his account his parents afterwards removed to that town. He became an earnest teacher in the Sabbath-school, and there are middle-aged people who still speak affectionately of the tall slender boy, whose smiling face and kind words gave them a kindly welcome to his class. He availed himself of every opportunity for intellectual improvement, but it was not till the year 1840 that an opportunity presented itself by which he could carry out his one great desire—to secure an education that would fit him for missionary work in India or China. Hearing of an institution in one of the Western States of America, where an opportunity for manual labour placed the means of a liberal education within reach, he determined, with the advice and approval of his father and brother, to make his way to this then far distant Western land. Many difficulties obstructed his path, but we find him a few months later delighted with the success of his undertaking, and patiently devoting himself to his studies. Graduating from the collegiate, he entered the theological, department of the institution, and by his earnest devotion to his work and his unassuming demeanour won the esteem of his professors and made many friends. In the autumn of 1847 he entered the Union Theological, New York City, from which he took his degree during the year 1850. In the mean time having corresponded with the London Missionary Society in reference to China, he was led to turn his attention to some other field of labour. The late venerable Rev. Dr. Storrs, of Massachusetts, took a deep interest in him, and recommended him to a pastoral charge in that state. After a short connection with this church he was selected from upwards of forty candidates to assume the pastorate of a Congregational church in a beautiful town on the Massachusetts frontier. From long-continued mental application and arduous labours his naturally delicate constitution began to give way, and

in April 1857 he obtained leave of absence for a short visit to his native land. He met his brother Dr. Livingstone in London and was with him much while he was engaged in preparing his first volume, 'Missionary Travels in South Africa.' Their long separation and warm Christian sympathy in the great work to which they had mutually devoted themselves (the amelioration of mankind) had greatly endeared them to each other. The Doctor gladly availed himself of his brother's assistance in the preparation of the book, and finding him so valuable an assistant, urged him to accompany the newly-projected "Expedition to the Zambesi." It was not without a severe struggle that Charles Livingstone decided to leave his little family and the fond attachments that he had formed in America to accept this proposal; but the idea of renewed health and strength for more successful labour in his own church led him to accept the offered position, and in March 1858 he left England for the untried scenes of a wild and uncivilised land. Through privations, difficulties, and dangers of every kind he was the Doctor's faithful assistant and companion. In 1864 he was spared to return to America, after an absence of nearly seven years from his family.

Close mental application renewed his nervous difficulties, and he was compelled to resign all thought of resuming his ministerial calling. After writing out his journal he again came to England, and in connection with the Doctor published 'The Zambesi and its Tributaries.' In October of the same year he accepted the appointment of "Her Majesty's Consul at Fernando Po"—"a fever and hunger-stricken island on which *no* animal, horse, cow, mule, sheep, goat, or dog can subsist," as he afterwards describes it. In 1867 an accession to his consular district was made of the "Bights of Benin and Biafra, including the mouths of the Niger," by Lord Stanley. It was in visiting these rivers in an unsuitable gunboat that he contracted the diseases (bronchitis and asthma) from which he was a great sufferer for the remainder of his life, in addition to the fever of the country, of which he had his full share. Notwithstanding all this he spared no effort to open Africa to civilising influences. His upright consistent Christian life gave him great influence with the chiefs, who often came of their own accord to seek his advice. He persuaded them to abolish many of their cruel and heathenish customs, and gave them instructions and suggestions for the better government of their people, from which they gave him the title of "The Settle Man." He was regarded by the missionaries of all

denominations as their warm and steadfast friend, and at all times took a deep interest in the progress of their work.

The Okrikas, a savage, cannibal tribe, becoming troublesome to their neighbours, he determined on a visit to them, being the first white man that had ever visited them. He sat for four hours in council with their chief and headmen, every eye fixed upon him. They took him to their juju-house, and showed him the skulls of their victims. At night they gave him an inner room ornamented with bones and skulls strung in fantastical array. His couch was composed of rude boxes, and such was their eagerness to view the white man that they could scarcely be persuaded to leave him. This visit seemed to result in great good to the Okrikas. Their chiefs were arbitrators in the late treaty with the Bonny Opobo tribes, and our allies in the Ashantee War. He was devoted to what he believed to be the highest interests of his country and humanity, and particularly sensitive to anything that tended in any way to tarnish the glory and reputation of England, a country to whose service he gave fifteen of his best years, sacrificed his health, and eventually his life. He died near Lagos, October 28, 1873, of African fever.

M. FRANCIS GARNIER.—The news of the death of this distinguished traveller and *savant*, a Lieutenant of the French Navy, slain in the performance of his duty in Tonquin on 20th December, 1873, was received by his fellow-geographers in England with feelings of profound sorrow. It will be in the recollection of many members of the Society that he attended in person at our Anniversary Meeting of 1870, to receive our Patron's Medal of the year for his exploration of the course of the Mekong River and journey through Western China. On that occasion my predecessor, Sir Roderick Murchison, summarised the deeds of the young officer, who, it will be remembered, succeeded to the command of the Cambodian Scientific Mission on the death of its commander, Captain de Lagrée, in the following words:—"In the course of this expedition, from Cratieh in Cambodia to Shanghai, 5392 miles were travelled over, and of these, 3625 miles, chiefly of country almost unknown to us, were surveyed with care, and the positions fixed by astronomical observations. In carrying out this important mission, your commander succumbed to the fatigues and privations of the harassing march between the head-waters of the Mekong and Tong-chuan, in the centre of Yunnan. Through his illness the progress of the

undertaking was for a time arrested ; for one of the chief objects—a visit to Tali-fu—seemed little likely to be realised. But you nobly volunteered to undertake this hazardous journey, and, your commander having consented, you made a rapid march to the rebel stronghold, satisfactorily fixed its geographical position, and returned in safety to Yunnan, where you found your chief had died during your absence. Disinterring his remains for conveyance to your native country, you crossed to the nearest port on the Yang-tsze, and, embarking in a native boat, brought the remainder of your party in safety to the mouth of the river." Subsequent to his visit to England he brought out, under the auspices of the French Government, his fine work, the 'Narrative of the Cambodian Expedition,' in two quarto volumes, with 22 sheets of maps, and 47 pictorial illustrations ; a typical example of what a complete report of a great national expedition of geographical exploration ought to be.

Despatched in 1872 again to the French Possessions in Indo-China, he met with his death, it is believed by treachery, at the hands of the Chinese rebels of Tonquin. He was born at St. Etienne on the 25th of July, 1839 ; he died, therefore, at the age of thirty-four years.

Colonel EMIL VON SYDOW,\* an Honorary Corresponding Member of our Society, was born at Freiburg, in the kingdom of Saxony, on the 15th July, 1812, and was the son of a well-known contributor to the *belles lettres* of that day. He received his education partly in the Gymnasium, afterwards in the Divisional School at Erfurt, where he at once showed the strong leaning towards the study of Geography which characterised his career through life.

With the completion of his 18th year he became an officer in the 31st Regiment of the Prussian Army, and in his 21st was attached as Master to the Divisional School, where he remained in activity ten years, latterly exclusively in charge of the Geographical Department, and where, in the year 1838, he published his first collection of wall maps. Called in 1843 to Berlin as a member of the Commission for Military Examinations, Sydow entered into close relation with Alexander von Humboldt, Carl Ritter, and other celebrities, more especially as regarded his favourite study. He also superintended the geographical studies of Prince Albrecht of Prussia, and

\* By Major-General Beauchamp Walker.

in the year 1849 was appointed Lecturer on Military Geography at the new Academy, in which post he remained, with an interval of five years, to the end of his life.

During the mobilization of 1850-51, Sydow was employed as Staff Officer of the 4th Cavalry Division in Electoral Hesse. A characteristic anecdote falls into the events of this period. A suspected peasant being brought before him for examination, declared that he came from a district which we will call N. "From N.," said Sydow, "and you have red mud on your boots? You come from B." The suspected lost all confidence, and hastened to divulge all that was required of him. Not only had Sydow occupied himself with the study of Geography; he added to this branch of science that of Cartography, to which he now fully devoted himself. With this object in view he retired from active service in 1855, established himself in Gotha, where Bernhard Perthes was about to commence the publication of the '*Geographische Mittheilungen*,' for which he subsequently wrote a series of articles, entitled '*Der Kartographische Standpunkt Europas*' In 1860 he returned to the service as Major, and was attached to the General Staff. Seven years later he became chief of a section in the subsidiary or purely scientific branch, and in 1870 was promoted to the rank of Colonel. Here he remained till the day of his death. The services which he rendered to his country in this capacity can hardly be overvalued; first in 1866, later and in a far higher degree in 1870-71, the work of his Department furnished a supply of maps to the Army which led in no small degree to the extraordinary successes of these eventful periods. In 1855 he was distinguished by the receipt of the large gold medal for Arts and Sciences, with the portrait of King William IV. He had married happily early in life, and was the father of three noble sons, the eldest of whom fell on the 28th June, 1866, at Soor-Burgendorf, as an officer of the Fusiliers of the Guard; the second was killed on the 18th August, 1870, before St. Privat, as an officer of the 3rd Foot Guards; the youngest, also an officer of that regiment, fell covered with wounds in the same battle, but, thanks to the skill of the well-known Professor Esmarck, has so far recovered as to be able to resume his duties. Last year (1872) Sydow lost his wife; the true partner of his joys and sorrows broke down under the accumulated misery of the loss of two, and the sufferings of her remaining son. I well remember the grief with which he told me of this sad bereavement. His death resulted from the after-consequences of an attack of cholera on the 13th

October, 1873, in the sixty-second year of his active and resultful life. A more amiable companion I have never known: add to this that he was a true servant of his King, a kindly superior and teacher, a good and genial comrade, and we have the picture of a man whose loss will long be felt by his country and by all who knew him. Peace to his ashes!

His principal works were the following:—

1. A School Atlas, in 42 sheets, which reached, as early as in 1867, the 20th edition.
2. Methodic Hand-Atlas for the scientific Study of Geography. 34 sheets, four editions, and on the fifth of which he was occupied at the date of his death.
3. Map of Thuringia and the Harz. 1841.
4. Atlas for the German Translation of Thiers' 'History of the Revolution, the Consulate, and the Empire.'
5. Hydrographic Atlas, in 27 sheets.
6. Orographic Atlas, in 24 sheets.

Besides these, he published a number of outline Maps, calculated for the use of schools. The elucidations of these works were also from Sydow's pen, and were for the most part published in the periodicals of the day.

For the 'Militär Wochenblatt' he published, in 1864, 'A Review of the most important Maps of Europe;' later his labour of love, 'The Register of the Geographical Statistical Department of the General Staff,' over which he presided with such marked ability. His brochure, 'North Italy, a Military Geographical Sketch,' was published in the Journal 'Unsere Zeit,' in 1860, but is incomplete, inasmuch as it wants the hydrographic portion of the work, although supplemented by an excellent Map of North Italy, compiled for the use of the Cadets' school, in whose possession it is still to be found.

PROFESSOR CHRISTOPHER HANSTEEN, of Christiania, an Honorary Corresponding Member of our Society, died on the 11th of April, 1873, in the eighty-ninth year of his age. Educated first in the Cathedral School of his native city, and afterwards in the Gymnasium of Fredericksburg, he showed at an early age a predilection for mathematical and physical studies, and in 1819 he made for himself a wide reputation in the scientific world by his work, 'Researches in Terrestrial Magnetism.' This important branch of science became his speciality, and the progress it made during a

series of years following the appearance of his first treatise, is in great measure indebted to his investigations and works. In 1828-30 he undertook a journey through Russia and Siberia, the results of which were given to the world in a narrative published in 1863.

Sir PAUL EDMUND DE STRZELECKI.—Sir Paul Edmund de Strzelecki, generally known as Count Strzelecki, a Fellow of this Society, died at his residence in Savile Row, on 6th December, 1873, in his seventy-seventh year. He was a native of the Grand Duchy of Posen, in the kingdom of Prussia, and came of a family of Counts by both parents, his father being Count Francis de Strzelecki and his mother the Countess Ann de Ruczynskish, the proprietress of Glucyna, in the parish church of which place he was baptised on 21st July, 1797. The prospects of his early life were chequered by the misfortunes of his native country, as he witnessed the French invaders in possession of the Grand Duchy, and had a painful recollection of the head-quarters of General Marmont being established in his father's chateau. After the alliance of the Four Great Powers had brought back peace to Europe, Count Strzelecki pursued a course of scientific study at the University of Heidelberg, where his taste for foreign travel evinced itself in early life, and he spent his vacations in long and careful pedestrian expeditions into Switzerland and Italy, studying the mineralogy and botany of those countries, and familiarising himself with the use of the barometer, in determining the vertical configurations of the chief mountain ranges and the fall of the rivers. Before setting out on his voyage round the globe, he visited the north of Scotland in 1830, and studied the system of sheep-farming pursued by Patrick Sellar, Esq., in the county of Sutherland, contrasting its peculiarities with the system in practice at Wartemberg, in Silesia, on the estate of Prince Biron of Courland. The knowledge thus acquired was of great importance to him subsequently in New South Wales. In 1832 he resolved to put into execution his long-cherished project of a voyage round the globe, and directed his course first of all to Canada. Here he explored the country of the Upper Lakes and discovered its rich deposits of native copper, which he thought right to bring to the notice of the Colonial Office. He passed some time also amongst the aboriginal Indian tribes, studying their character and their habits, and, striking southwards into the territory of the United States, emerged into civilised life at Washington, where he was hospitably received by

the President, Andrew Jackson. Directing his course southward, he arrived at Rio Janeiro in the autumn of 1835, where his MS. journal recounts his explorations of the virgin forests of the Sierra Estrella. Thence he proceeded to Buenos Ayres, where he was the guest of General Rosas in August, 1836. After that he ascended the River Parana into Paraguay, and was welcomed by the Dictator Francia, from whose hospitality he had some difficulty in escaping into the territory of the Indians of the Gran Chaco. Returning thence to Santa Fé, he struck across the territory of the Argentine Republic to Mendoza and crossed the Cordilleras of Chili by the pass of La Cumbre, witnessing the phenomenon of melting snow at an elevation of 15,000 feet, whilst the snow lower down, at the elevation of 10,000 feet, was found unaltered. Thence he descended by Santa Rosa to Valparaiso, where he availed himself of the hospitable invitation of the Hon. Captain George Grey, and visited with him, on board H.M.S. *Cleopatra*, the Pacific Coast of America from Chili to California, landing in Mexico and passing some time in the province of Sonora. An extract from his MS. journal depicts in bright colours the high civilisation of this province and the happy relations which existed in 1837 between the descendants of the Spanish settlers and the Yakies or native Indians. "Everywhere," he writes, "abundance is visible—everywhere are seen the signs of a generous and open hand. Avarice, penuriousness, want, and suffering, seem to be unknown. Health, peace, and content, appear to reign in undisturbed possession of this region." On his return to Valparaiso Count Strzelecki accepted the hospitality of Captain Russell Elliott, and accompanied him on board H.M.S. *Fly* to the Marquesas, the Sandwich, and the Friendly islands. He arrived at Tahiti at a very interesting moment, when what has been termed "the Pritchard difficulty" very nearly brought on war between France and Great Britain. Here he became the guest of Queen Pomare, and he may be said to have inaugurated "Trial by Jury" in her dominions, as he sat as foreman on the first mixed jury empanelled in that country, to try an Englishman accused of the murder of a native. An account of the gigantic volcano of Kiraeua, in the island of Hawaii in the Sandwich group, has been introduced by him into his description of the Crystalline Rocks of New South Wales, with some valuable observations on the scientific classification of volcanic products. Count Strzelecki took leave of Captain Russell Elliott at Tahiti, in November, 1838, and proceeded in a merchant-vessel to New Zealand, and thence to New South Wales, where he arrived at

Sydney in April, 1839. His main object in visiting New South Wales was to study its mineralogy; but he soon discovered, as he himself states in his 'Physical Description of New South Wales and Van Diemen's Land,' that the scarcity of the simple minerals in that country was such as to discourage him from prosecuting any extensive mineralogical researches. His excursions, however, which he made with that object, disclosed to him a field of geological investigation of a most interesting character, and he was induced, at the urgent solicitation of Sir George Gipps, the Governor-General of New South Wales, "in the interest of science and of the colonists," to undertake a systematic survey of that portion of New South Wales which extends from  $30^{\circ}$  to  $39^{\circ}$  of south latitude, running nearly parallel with and stretching 150 miles inland from the coast. The labour of this survey was very great; it occupied him for five years. He made, to use his own words, 7000 miles on foot; he incurred an outlay of 5000*l.*, and he prepared a geological map of New South Wales and of Van Diemen's Land on the scale of one inch to the mile, which he was unable to take upon himself to publish in this country from a disappointment in the recovery of funds for that purpose, consequent on the premature death of Sir George Gipps.

"His intention," he states, "when he set out from Sydney, had been to make Wilson's Promontory, the south-eastern extremity of New South Wales, the closing point of his survey;" but he was led to pursue the enquiry into the islands of Bass' Straits, and from those islands to Cape Portland and Research Bay in Van Diemen's Land. Here he found such striking correspondence of parts to the explored tracts of New South Wales, that he could not resist the temptation to extend his explorations, until they finally brought him to South Cape, in Van Diemen's Land, and thus he was enabled to join New South Wales and Van Diemen's Land in one geological survey. To the value of Count Strzelecki's contributions to physical geography our late distinguished President, Sir Roderick Murchison, has borne ample testimony in his Presidential Address of 1844.

Of the discoveries made by Count Strzelecki after his arrival at Sydney, the most important were those made by him in New South Wales. In fact, he himself states that he made no discovery of importance in Van Diemen's Land, where, however, he received every assistance from Sir John Franklin, then Governor. But with regard to New South Wales he made the discovery, in the month of October, 1839, that extensive gold-fields existed in

Bathurst, Wellington, and other districts, which he disclosed to Sir George Gipps, and at his earnest request kept secret from the public, "lest, if he made known his discovery, the maintenance of discipline amongst the 45,000 convicts, which the Australian colonies then contained, might be almost impossible." His other important discovery was accomplished in 1840, when he penetrated through a series of rugged and sterile defiles into a most beautiful and richly-watered tract of country, which he named "Gipps Land," in honour of the Governor-General of the colony. This district had hitherto been cut off from the rest of New South Wales by the formidable chain of the Australian Alps on the north, and by a zone of almost impenetrable scrub on the south, through which he was obliged to cut his way for 26 days, advancing only at the rate of three miles a day, and having to abandon a property in pack-horses and various valuable articles, which they carried, to the amount of 700*l.*

Sir George Gipps, in inducing Count Strzelecki to undertake so laborious a survey, was well aware of the sacrifice of time and money which it would impose upon him, and he accordingly assented to the Count's proposal, "that the Colonial Treasury should be associated with the enterprise and defray half the expenses, and further assured him, in case his researches should lead to results likely to benefit the public, he would recommend her Majesty's Government to repay him all the outlay which he might be obliged to incur in his expedition."

Having completed his labours in the two colonies, Count Strzelecki resumed his original voyage, and visited Java, Borneo, and the Philippine Islands, and thence proceeded to China, and, having accomplished his projected tour, returned to England by way of Egypt in the latter part of 1843. Here he was met by the unwelcome news that Sir George Gipps had been recalled from his government and had died a fortnight after his arrival at Southampton. This event was attended with a painful disappointment to the Count, as he had relied on the intervention of Sir George Gipps with the Colonial Office to obtain for him at least the recovery of half the outlay which he had been obliged to incur in his explorations, but the Colonial Office saw no other way of indemnifying him than by offering him an appointment in New South Wales, if he should be disposed to return there. This he declined to do, as it would have defeated his plans for making known to the scientific world of Europe the results of his travels. The liberality, however,

of the Tasmanian public came to his aid in some degree, and their gratitude in subscribing a sum of 400*l.*, as a contribution towards the completion of his labours in illustrating the physical phenomena of Van Diemen's Land, determined him to venture on the publication of his 'Physical Description of New South Wales and Van Diemen's Land.' This work appeared in 1845, and at once placed the name of Count Strzelecki on the roll of distinguished geographers. Science, however, has to regret that he was soon called away from his labours as an author to undertake the relief of suffering humanity, as he accepted the self-imposed and self-remunerated mission of distributing, during a period of four years, from 1846 to 1850, amongst the famine-stricken peasantry of Ireland, the relief which the liberality of the British public had collected for them. During this period he left the question of the discovery of gold and his other claims to the course of events. Meanwhile, however, the discovery of the precious metal in New South Wales had oozed out, and later explorers not merely enriched themselves suddenly, but claimed the reward offered by the Legislative Council of Sydney to the discoverer of gold. That reward, however, was not distributed until 1853, when the Legislative Council supported the proposal of the Executive Government of the colony that the sum of 5000*l.* should be given to those who first published the discovery and taught the miners how to wash the gold, and not to him who first made the discovery and kept it secret at the express request of the Executive Government. Justice, however, was done to Count Strzelecki's scientific researches in the course of the debates of the Legislative Council in its sitting on 5th October, 1853, and his claim to the discovery of the gold-fields in 1839 was established beyond all dispute. Successive Ministers of the Crown in this country have also borne their testimony to the great services of Count Strzelecki, but, like many other public benefactors, to use the words of the Secretary of State for the Colonies in 1866, "he has had only the reward which being conscious of public service gives."

Count Strzelecki, after his return to England, obtained letters of naturalisation as a British subject in 1845. He was a Fellow of the Royal Society, and received the honorary degree of D.C.L. from the University of Oxford. He was made a Companion of the Order of the Bath in acknowledgment of his public services during the Irish famine, and, after the Order of St. George and St. Michael was extended to the Colonies, he was created, on the recommenda-

tion of Mr. Gladstone, a Knight Commander of that Order, in recognition of his great services in her Majesty's Australian colonies.

Vice-Admiral Sir ROBERT M'CLURE, C.B.—Robert John le Mesurier M'Clure, born at Wexford 28th January, 1807, was the posthumous son of Captain M'Clure, of the 89th Regiment, an officer who served with distinction under Abercrombie in Egypt, and stood beside his General when he fell mortally wounded at the battle of Aboukir. At four years of age he was entrusted to the care of his godfather, General le Mesurier, the hereditary Governor of Alderney, with whom he resided at the Governor's house until 1819, when he was sent to Eton, and thence to Sandhurst. But the military profession being distasteful to him, at the age of sixteen he entered the Navy on board H.M.S. *Victory*. During the next twelve years he served in various parts of the world, passing his examination for Lieutenant in 1830.

In 1836 Sir Charles Adam applied to M'Clure to join an expedition fitting out for the North Pole; he at once assented, and was appointed to the *Terror*, commanded by Captain (now Admiral Sir George) Back, on a voyage to Repulse Bay. The vessel left Chatham on the 14th June of that year, and crossed Davis Strait on the 28th July. Here M'Clure gained his first experience of ice-navigation amidst the most appalling dangers: "a voyage," as Sir John Barrow observes, "of a nature extraordinary and unparalleled in the history of voyages, ancient or modern." On the return of the expedition towards the end of 1837, M'Clure received his Lieutenancy, and on the 1st February, 1838, was transferred to the *Hastings*, and afterwards to the *Niagara* on the Canadian lakes, where he distinguished himself by the capture of the leader and dispersion of a band of desperadoes, who had long set the authorities at defiance. Subsequently he was placed on the West India station from August, 1839, until 1848.

When it became necessary, after three years without tidings, to send an expedition in search of Sir John Franklin, the *Enterprise* and *Investigator* were fitted out under the command of Sir James Ross, and M'Clure was appointed First Lieutenant of the *Enterprise*. This expedition sailed in May, 1848, and after long detention in Baffin's Bay, entered Lancaster Sound, making the harbour of Port Leopold on 11th September, and here Sir James Ross was obliged to winter. In September, 1849, the ships got out of harbour and into Barrow's Strait, where they were closely beset by ice and carried out of Lan-

caster Sound into Baffin's Bay, compelling them to return to England. On his return M'Clure was promoted to the rank of Commander, and almost immediately the Admiralty resolved to despatch another searching expedition by way of Behring Strait, for which M'Clure again volunteered his services.

The new expedition consisted of the same two vessels, the *Enterprise*, commanded by Captain Collinson, and the *Investigator*, by Commander M'Clure. They sailed from England on the 20th January, 1850, but were separated in a gale of wind in the Straits of Magellan on the 20th April, and never encountered each other again. M'Clure reached the Sandwich Islands in July, and made the ice on the 2nd August. Keeping close along the American coast, he rounded Point Barrow, the extreme point to which exploration had been carried by a ship from the westward. All through August the *Investigator* encountered difficult navigation. On the 9th September they were only 60 miles from Barrow Strait: a few hours of clear sea and fair wind, and M'Clure would have connected the discoveries of Beechey on the west, with those of Parry on the east. But on the 11th they were beset; yet some further progress was made, and on the 16th the *Investigator* was only 30 miles from Barrow Strait. Here the ship wintered in the pack, and in October M'Clure started with a sledge party to the coast of Banks' Land, in the hope of solving the problem of a north-west passage in this direction. On the 26th they ascended a hill and obtained a view which settled the question affirmatively.

During the remainder of 1850, 51, and 52, M'Clure remained in these desolate regions, chiefly shut in by the ice, or proceeding slowly, retracing the latter part of his voyage, rounding the southern extremity of Banks' Land and coasting along its western shore. The dreary winters were passed in hunger and anxiety. Meanwhile unexpected aid was at hand: H.M.S. *Resolute*, commanded by Captain Kellett, arrived at Melville Island in September, 1852, and on the 6th April following, Lieut. Bedford Pim and Dr. Domville, who had been despatched from that vessel, reached the *Investigator*. "Despondency fled the ship, and Lieut. Pim received a welcome that he will assuredly remember and cherish to the end of his days."

Eventually Commander M'Clure was persuaded, though most reluctantly, to abandon his well-tried vessel, and on the 3rd June, 1853, he and his crew turned their backs on the old *Investigator* with feelings of sorrow. They reached the *Resolute* on the 17th June,

but had yet to face another winter on these inhospitable shores. The *Resolute* had to be abandoned, and after a march in the spring of 1854 to Beechey Island, took passage home in some whaling-ships. And so they made the long-sought North-west Passage. M'Clure and his gallant officers and crew are the only men who have passed from ocean to ocean to the north of the American continent. It was a glorious feat, of which the British Navy may well be proud.

The Royal Geographical Society presented M'Clure with their Gold Medal in 1854, in anticipation of his return; and a gold medal was also presented to him by the French Geographical Society. He became a Member of our body in 1855.

Captain M'Clure's commission was dated back to the day on which the existence of a continuous ocean was discovered from the hill on Banks' Land; he also received the honour of knighthood on his return to England, and a reward of 10,000*l.* was granted to the officers and crew of the *Investigator*, upon the recommendation of a Select Committee of the House of Commons, as a token of national approbation.

After his return from the Arctic regions he remained only about two years on shore. In March, 1856, he commissioned H.M.S. *Esk* at Sheerness, and proceeded in her to the China station, where he did good service during the war. In January, 1858, he was at the attack and storming of Canton, and in the latter part of his commission he was commanding officer at Singapore. He returned to England in the autumn of 1861, and received a Companionship of the Bath for his services in China. He did not serve again. He became a Rear-Admiral, and in due course a Vice-Admiral on the retired list.

The latter years of his life were spent in rest and enjoying the pleasures of a country life. He was abroad last summer for his health, when he was attacked by his last illness; he begged to be brought to England, and in his lodgings in Duke Street he calmly breathed his last on the 17th October, 1873, aged 66 years and 8 months. He was buried at Kensal Green Cemetery on Saturday, the 25th October, surrounded by brother officers in the Naval service, and men eminent in the ranks of geographical research.

SIR HENRY HOLLAND, M.D.—We have to record among our losses during the past year, that distinguished physician Sir Henry Holland. His career in life was an exceptionally prosperous and favoured one. It was remarkable for its long duration, its bril-

lianoy, its scientific utility, and its beneficence ; and what made it most notable was, that Sir Henry by his position was brought intimately into relationship with the most prominent persons in public life during some of the most eventful years of the world's history. Few could more appropriately quote, as he has done on the title-page of his Autobiography, the words of Martial—

“Hoc est  
Vivere bis, vita posse priore frui.”

He was born at Knutsford, in Cheshire, on the 27th October, 1787, and died last year on his birthday, thus completing his eighty-fifth year. He was educated at a Bristol school, where he succeeded the late Lord Broughton, then John Cam Hobhouse, as head-boy. For a short time, after leaving school, he was in a merchant's counting-house in Liverpool ; but before he was eighteen he took to the study of medicine in Edinburgh, where he graduated in the autumn of 1811, the subject of his Latin thesis being “The Diseases of Iceland,” a country which he had himself already visited. As he was yet too young by three years for admission to the College of Physicians in London, he determined on making a tour of the Mediterranean and bordering countries, which resulted in the publication, in 1815, of a very valuable work, entitled ‘Travels in the Ionian Islands, Albania, Thessaly, and Macedonia, during the years 1812 and 1813.’ In 1814 he received the appointment of Domestic Medical Attendant on the Princess of Wales, afterwards Queen Caroline, on the understanding that he should accompany Her Royal Highness on her travels and during the first year of her contemplated stay on the Continent. Subsequently established in the pleasant practice of a West End physician, which, as he himself frankly admits, “abounds in cases which give little occasion for thought or solicitude, and are best relieved by a frequent half-hour of genial conversation,” he yet found time for laborious scientific research, as shown by his published writings ; to wit, his ‘Medical Notes and Reflections,’ published in 1839 ; his ‘Chapters on Mental Physiology,’ published in 1852 ; and his ‘Essays on Scientific and other Subjects, contributed to the Edinburgh and Quarterly Reviews,’ published in 1862. During the whole of his long life it had fallen to his lot to associate with all that was most distinguished for rank, genius, wit, learning, and refinement, not only in his own country, but in every capital of the civilised world. There was not a President or leading statesman in America that he could not call his friend. As a physician he had the heavy responsibility, as well as high honour, of

enumerating among his patients Kings and Princes, Prime Ministers, Chancellors, statesmen, and jurists, and most of those who were highly distinguished among his contemporaries for public services and for literary or scientific ability. But what is more surprising in his career, and more interesting to us as Geographers, is, that our late distinguished associate, though apparently bound by such ties of responsibility as these, contrived to indulge himself in a yearly ramble to some remote part of the world, selecting the long vacation, when most of his patients were also absent, for his holiday. In this way he managed to cross the Atlantic sixteen or seventeen times; travelled over more than 26,000 miles of the American Continent; made four expeditions to the East; three tours in Russia, two in Iceland, several in Sweden, Norway, Spain, Portugal, Italy, and Greece; innumerable voyages to the Canaries, Madeira, and West Indies, and, to use his own words, "other excursions which it would be useless to enumerate." He joined with good effect the Deputation which, on the 16th December, 1872, waited on Mr. Goschen and the late Chancellor of the Exchequer, to press the subject of an Arctic Expedition upon the notice of Government; and made some very appropriate remarks on the scientific results to be anticipated from such an undertaking.

In his various tours it was his habit to carry with him the smallest amount of "impedimenta" possible; all who chanced to meet Sir Henry abroad, whether in the Arctic zone or the Tropics, on the Prairies or the Pyramids, found him always in the same black dress-coat in which he was so well known in London. His life was one long spell of healthy and intelligent activity. Three days before his death, on Friday, the 24th of October, he attended the Bazaine trial at Versailles, and dined at the British Embassy in Paris, "cheerful and happy, and full of conversation." On the 27th he died at his house in Brook Street, without any serious illness, but like a ripe shock of corn in its season, and regretted and honoured by all who knew him.

THE BISHOP OF WINCHESTER.—In our retrospect of the whole of the past year we meet with no event which has more painfully affected the public mind than the suddenness of the death of our illustrious associate, the Bishop of Winchester. The catastrophe was the more startling that this distinguished prelate was taken from us while in the full possession of those brilliant powers which rendered him so conspicuous an ornament, not only to this country, but to this age.

Samuel Wilberforce, the third son of the illustrious William Wilberforce, who won for himself undying fame by the share he had in the abolition of the slave-trade, was born on the 7th September, 1805, and had therefore nearly completed his 68th year at the time of his death. He received his early education at Edgbaston, near Birmingham, under the care of Archdeacon Hodson, and in due course was entered as a Commoner at Oriel College, Oxford. As an Undergraduate he commenced, at the Union Debating Society, the cultivation of that eloquence for which he subsequently became so remarkable. In 1826 he took a second class in Classics, and a first in Mathematics; his name standing in the Class-list side by side with Bishop Trower, the late Dr. Mortimer, Archdeacon Denison, Lord Henry Bentinck, and the late Lord Newark. In 1828 he received ordination from Dr. Lloyd, the then Bishop of Oxford, his "title" for orders being the curacy of Checkendon, in Oxfordshire, where he won for himself great affection by his goodness to the poor. In 1830 he was appointed to the living of Brightstone, in the Isle of Wight, the gift of Bishop Sumner of Winchester, to whose see he afterwards succeeded in Dr. Sumner's lifetime, but whom, nevertheless, he did not outlive. In 1839 the Bishop gave him the Archdeaconry of Surrey, and a Prebendal Stall in Winchester in 1840. In 1841 he was promoted to the rectory of Alverstoke, near Gosport, a populous parish, where he had Dr. Trench, the present Archbishop of Dublin, for his curate; and, in 1843, he was appointed one of the chaplains to His Royal Highness the late Prince Consort. In 1844 he received from the then Archbishop of York the appointment of Sub-Almoner to the Queen, and early in 1845 was promoted to the Deanery of Westminster, whence, before the close of the next year, he was advanced to the Bishopric of Oxford, an appointment which carried with it the Chancellorship of the Order of the Garter. In 1847 the Bishop received the dignity of Lord High Almoner to Her Majesty. In 1869, on Bishop Sumner's resignation of the Bishopric of Winchester, Bishop Wilberforce was translated to that important see.

The melancholy circumstances of his death are fresh in the minds of us all; but it is my sad duty to recount them here, simply by way of placing them on record in this obituary notice.

On Saturday, July 19th, 1873, his Lordship, accompanied by Lord Granville, left London by the South-Western Railway with the intention of paying a short visit to the Hon. Edward Frederick

Leveson Gower, at Holmbury, near Dorking, where Mr. Gladstone had arrived to meet them. At Leatherhead they were met by a groom with horses, and the Bishop mounted one which, on account of its quietness, was a special favourite of Lord Granville's. They took Ranmoor Common in their way, and followed the bridle-road towards Leith Hill. In going down the hill towards Abinger, the road at Evershed's Rough being very full of ruts, they left it for the turf, which, though light and springy, was not good galloping ground. While the Bishop was in conversation with Lord Granville, his horse stumbled, it is thought, over a stone, and his Lordship was thrown on his head. The neck was dislocated, and death was instantaneous. Although removed so suddenly, while in the full vigour of his intellect, and with his grand energies unabated, the Bishop had well-nigh reached the term which is ordinarily assigned to human life.

Of the intellectual powers of the lamented Prelate, so well and so widely known, it seems almost superfluous for me to speak. A life of ceaseless practical activity seemed to leave little opportunity for prosecuting the literary studies for which his academical career proved that he possessed such extraordinary aptitude; but his eloquence and his command of language were such, that, whether as a preacher, a debater, or a platform-orator, he may be said to have been in his day almost unrivalled. His polished mode of thought and sparkling wit made his society a delight to his friends, and he knew how to add a piquancy, all his own, even to the witticisms of others, simply by his manner of repeating them. He took a warm interest in Geography, and had been a Fellow of our Society ever since 1846, and was twice on our Council, besides taking part for some years in our social gatherings. In an intimate acquaintance with the geography of his own country he was surpassed by very few. But perhaps the most remarkable characteristic of the late Bishop of Winchester, even more characteristic than his overflowing kindness of heart, was his inexhaustible energy. Apart from the vast correspondence entailed by his official position, he was able to find time for a great amount of volunteer work for churches and charities, and even though such toil would with many men amount to absolute drudgery, he always did his work well and with a hearty geniality. It must, moreover, be acknowledged that his efforts were invariably exerted with a view to the welfare, comfort, and assistance of those with whom his labours brought him into relationship.

LORD DE LA ZOUCHE.—The late Lord de la Zouche, known to the literary world chiefly by his former designation as the Honourable Robert Curzon, was born on the 16th March, 1810, the eldest son of the Baroness de la Zouche (baroness in her own right) and the Honourable Robert Curzon. His education was commenced at the Charterhouse, and completed at Christ Church, Oxford. It was whilst occupying the position of private secretary to Lord Stratford de Redcliffe at Constantinople that he undertook that holiday tour through portions of Turkey and Greece, visiting the various religious houses, convents, and monasteries, the results of which he gave to the world in his delightful book, ‘Visits to the Monasteries of the Levant,’ published by Murray in 1848. The description of his wanderings from convent to convent, scattered about the rocky islands, and perched on almost inaccessible promontories, and the curious literary treasures his good judgment and perseverance enabled him to bring to light, established his reputation as an Oriental traveller. He published a second book in 1854, entitled ‘Armenia: a Year at Erzeroom and on the Frontiers of Russia, Turkey, and Persia;’ but it was far from having the success of his former work, which has run through many editions, and still maintains its popularity. He was elected a Fellow of our Society in 1865. His death took place on the 2nd of August last.

KEITH EDWARD ABBOTT.—Mr. K. E. Abbott, during a lengthened period of service as Consul in various parts of Persia, distinguished himself by his contributions to our geographical knowledge of the country. His first appointment was to the Consulate of Teheran in 1841, whence he was transferred, in 1842, to Tabreez. On the death of Mahomed Shah, in the autumn of 1848, he was deputed, on the part of Her Majesty’s Legation at Teheran, to convey to the Heir-Apparent, the present Shah, Nasser-ed-din, the intelligence of that event, and to accompany His Majesty, as the official representative of the Legation, to the capital. He was appointed Consul of Tabreez in April 1854, and remained there till the rupture between England and Persia in 1856: returning to the same place, as Consul-General, on the renewal of relations with Persia, in July 1857. In July 1868 he became Consul-General of the Russian Ports in the Black Sea and Sea of Azof, residing at Odessa, and remaining there until his death on the 28th April, 1873. His first contribution to our ‘Transactions’ was a paper entitled ‘Geographical Notes, taken during a Journey in Persia in 1849–50,’ published in the

25th volume of our 'Journal.' The route followed by him during this journey led from Teheran to Savé, Kúm, Kashan, and Ispahan, and thence to Yezd, Kerman, Shiraz, and Bushire, on the Persian Gulf. Embarking at the last-mentioned place in an Arab boat, he crossed the Gulf to the mouth of the Shat ul Arab, and thence proceeded to Mohummeráh and Bagdad by the river; returning to Teheran by way of Kermanshá and Hamadán. His narrative was marked by great accuracy and conscientiousness, and his remarks on various places, rarely or never before visited by Europeans, attracted considerable attention among Oriental geographers at that time. Among his subsequent communications were his 'Notes on Ghilan' (the narrow strip of country on the south-western side of the Caspian), published in our 'Proceedings,' vol. iii., and his 'Memorandum on the Country of Azerbaijan' ('Proceedings,' vol. viii.). He had been a member of our body since 1869.

WILLIAM WHEELWRIGHT, the founder of the Pacific Steam Navigation Company, of the Central Argentine and Boca and Ensenada Railways, and of the Callao Waterworks, by whose projects and successful undertakings the Pacific Coast of South America has so materially benefited, was born at Newbury Port, Mass., U.S.A., in 1798, and died on 26th September, 1873, at his residence, Gloucester Lodge, Regent's Park. He was the eldest son of Ebenezer and Anna Wheelwright, and a descendant from an old Lincolnshire Puritan family. Educated at Andover College, Mass., he led a seafaring life from the age of 14 years, and was promoted to the command of a ship in 1823, thus acquiring a practical knowledge of most parts of the Pacific Coast. In 1829 he established himself at Valparaiso, and engaged in various enterprises for the development of that part of South America—such as the exploration of South Chili for coal, the establishment of gasworks at Copiapo, the projection of the railway from Callao to Lima, and the working of the railway from Caldera to Copiapo.

The most recent works in which Mr. Wheelwright was engaged were the Central Argentine and the Boca and Ensenada Railways. It is his peculiar merit that he undertook the first surveys for these various undertakings entirely at his own expense, and endeavoured to make them subserve the interests of various branches of science. This is shown by the paper which he communicated to our Society early in the year 1860, on "A proposed Railway Route across the Andes, from Caldera in Chili to Rosario on the Paraná,

*via Cordova*," which was afterwards published in the 31st volume of our 'Journal,' accompanied by a map furnished by his surveyor; a paper which illustrates questions of engineering in the proposed scheme of carrying a railway across the Andes, and communicates much information on the climate, the mineralogical productions, and agricultural resources of the regions traversed by the surveyors. Although great difficulties surrounded his project, an important section of it was realised, and the Central Argentine Railway remains a monument of the patience, energy, and ability of its author.

In private life Mr. Wheelwright was greatly esteemed, and he leaves behind him many friends who mourn his loss. He was a frequent attendant at our evening meetings, during those intervals in his active life when he resided in London; and he occasionally took part in discussions on South American subjects.

MR. HAMILTON HUME, who was elected a Fellow in 1860, was a native of Australia, his parents having been among the earliest settlers in the colony. In his early years he was hardy and athletic, as well as intelligent and spirited; and he acquired from the natives an unusual facility for finding his way without a compass. His explorations began in 1814, when he was only 17 years of age; as he discovered, in company with a younger brother, the country now called Berrima or Bong-Bong. In 1817, having been requested by Governor Macquarie to accompany Surveyor Mechan to the "new country," they discovered Lake Bathurst, Goulburn Plains. In 1818 he joined Messrs. Mechan and Oxley in an exploring expedition to Jervis Bay; and in 1821, in company with his brother and two friends, the Yaro Plains were discovered, at which place he afterwards fixed his residence. In 1822 he was engaged on Lieutenant Johnson's survey of the east coast in search of rivers; and the late Mr. Alexander Berry and he penetrated from the upper portion of the Clyde to the present flourishing town of Braidwood. In 1824 his most difficult task was undertaken. It was to cross the country overland from Lake George—which was then the limit of our geographical knowledge—to Port Phillip Bay. Though the expedition had been suggested by the Government, but in the converse direction, it received but limited aid, and was imperfectly equipped. Mr. W. H. Howell, who is also one of our Fellows, shared in the expenditure and accompanied the expedition. Starting on the 3rd of October, 1824, they reached, on the 24th of December, the

spot where the town of Geelong now stands. Mr. Hume's account of the district arrested the attention of stock-men and flock-owners, and the settlement of John Batman in 1827 was the first step towards the founding of the flourishing sister colony of Victoria. In 1828 he was associated with Captain Sturt in his attempt to trace the Macquarie River, and they discovered the Darling, which, in an unusually hot season, was salt at the point where they struck it. Sturt says : " I have on every occasion received the most ready and valuable assistance from Mr. Hume. His intimate acquaintance with the manners and customs of the natives enabled him to enter into intercourse with them, and chiefly contributed to the peaceable manner in which we have journeyed. I cannot but say he has done an essential service to future travellers, and to the colony at large, by his conduct on all occasions since he has been with me." In 1829 he was unable to accompany Sturt on his second expedition, and he soon after settled down as a country gentleman. He died on the 19th of April, 1873, having nearly completed 76 years. A monumental pillar at Albury, on the Hume River, was erected by the colonists several years ago, and he is commemorated in several local names ; and all the historians of the earlier days of the colony (including Rusden, the most recent) do full justice to the services which he rendered.

MR. HERMAN MERIVALE, born at Dawlish, November 8, 1806, was the son of Mr. Merivale, Commissioner of Bankruptcy, by Louisa, daughter of Dr. Drury of Harrow. Sent to Harrow at ten years of age, he entered Oriel College, Oxford, at seventeen, and was subsequently elected Scholar of Trinity and Fellow of Balliol. He graduated as first class in Classics, obtaining the additional honours of first Ireland University Scholar, and first Elder Scholar. Called to the Bar about 1830, his University successes gave promise of a legal career of unusual distinction ; but being elected as first occupant of Mr. Henry Drummond's Chair of Political Economy at Oxford, he devoted much time to his duties as Professor, and published his lectures on colonization, which led to his selection by Lord Grey as Under Secretary to the Colonies in 1847. Thenceforward he gave himself to official and literary labours, and in 1858 became Under Secretary to the India Office on its reorganization, in which office he continued till his death, 8th February, 1874. Besides his Lectures on Colonization and the Poor Laws, he published a volume of Historical Studies, many articles in the 'Edinburgh Review'

and other periodicals, and he completed the *Lives* of Sir Philip Francis and Sir Henry Lawrence, begun by others.

As a Fellow of this Society, he kept up a continued interest in works of geographical discovery, and in his official position at the Colonial and India Offices was ever ready to attend to matters of importance to the Society in India and the Colonies. But such an official position as his, whilst it, as in his case, absorbs talents and acquirements of the highest order, leaves little opportunity for achieving distinction by labours which oftener tend to help or correct others than to illustrate the individual labourers.

ADMIRAL FREDERICK BULLOCK, who died on February 6, 1874, in his eighty-seventh year, entered the navy in November, 1804, and served throughout the war, in the Channel, in the Mediterranean, and on the East Indian station. In 1823 he had command of the *Snap*, surveying vessel on the Newfoundland station, in which he accompanied Captain G. F. Lyon to the coast of Labrador, when that officer sailed on his voyage of Arctic discovery. He was afterwards employed on survey duties on the Home station and elsewhere.

MR. FREDERICK AYRTON began life as an officer of the Indian Artillery; but having resigned the service, he took up his residence in Egypt, to which country he devoted himself during the remainder of his life. He will be best remembered as a profound Arabic scholar, and for his researches into Egyptian History, especially since the Arab conquest. He formed a magnificent collection of Arabic calligraphs and MSS., which he bequeathed to the nation, though unfortunately the conditions with which the bequest was accompanied prevented their acceptance by the trustees of the British Museum. He was greatly respected in Egypt, where he so long resided, and was honoured by the Khedive with the title of Bey, as an acknowledgment of his services to H. H.'s Government.

MR. CHISHOLM ANSTEY.—Our obituary contains the names of few abler men than that of Mr. Anstey, whose great and varied learning and untiring energy promised, in the earlier parts of his career, to win him the highest position in the Senate or at the Bar. He had travelled much, and possessed a wonderful facility for the acquisition of foreign languages, and a vast amount of information on geographical subjects. He died at Bombay, where many of the

latter years of his life had been spent in successful practice at the Bar.

In addition to the foregoing, the losses of the Society by death include:—Sir J. W. H. Anson, Bart. (who perished in the fearful railway accident at Wigan in August last), William Blenkin, H. L. Bartlett, Charles John Bayley, F. Corrance, Thomas Combe, Donald Dalrymple, Dr. R. Dobie, General W. J. D'Urban, William Gladstone, Thomas Greene, James Holmes, Sir Ralph Howard, Bart., J. B. Key, Lionel A. Levert, Thomas Letts, Lord Lyveden, W. Hanks Levy, W. Blake Lambert, Captain R. M. Murchison, Rev. John Mills, James Garth Marshall, Captain Alexander Mitchell, The Baron H. de Maltzan, General G. T. C. Napier, James Dyce Nicol, M.P., W. T. Paliologus, E. B. Philipps, F. Pearson, R. D. Parker, A. A. Paton, Sir George Rose, Sir David Salomons, Bart., Ernest A. C. Schalch, Colonel D. W. Tupper, M. E. de Verneuil, Colonel W. Wood, Edward Wates, and Commr. A. Wing.

#### ADMIRALTY SURVEYS.\*

The hydrographical surveys undertaken by the Admiralty during the past year have embraced districts in the following countries:—England (south and east coast), Ireland (east coast); Mediterranean; Red Sea; East Coast of Africa (north and south of Zanzibar). In Australia, the provinces of West Australia, South Australia, Victoria, and Queensland. In West Indies, Jamaica and Barbadoes. In North America, Newfoundland. Western Pacific Ocean. These surveys have employed three of H.M. steam-ships —viz., the *Shearwater* of 670 tons, the *Nassau* of 695 tons, the *Porcupine* of 380 tons, one Colonial steam-vessel, two small hired steam-vessels, three hired sailing-vessels, and a steam-launch; and have been conducted by twelve naval officers in charge, with forty-seven naval officers as trained assistants, and have given employment to about 350 men.

To these surveys must be added the deep-sea exploratory voyage of H.M.S. *Challenger* (1460 tons, 400 horse-power), commanded by Captain George S. Nares, with a complement of 23 officers and 213 men, aided by a civilian scientific staff of five gentlemen, with Professor Wyville Thomson, F.R.S., as their chief.

*East and South Coasts of England.*—Staff-Commander Parsons and his staff, in the *Porcupine*, have performed good service in closely

\* By Captain Frederick J. Evans, C.B., F.R.S., Hydrographer.

sounding the approaches to Harwich; the work extended from Orfordness to the Naze, and included seaward as far as the Shipwash and Gunfleet sands. A similar close examination of the shore from the South Foreland to Dungeness followed; the sounding extending from the coast from three to five miles. Dover bay was also surveyed in close detail, in anticipation of proposed harbour works, in continuation of the Admiralty pier.

Staff-Commander D. Hall has made during the past season, in addition to local surveys of the Medina river and Cowes roads, a minute examination of the bar at Portsmouth harbour. This survey, consequent on the dredging operations of 1871-2, shows that the proposed depth of 20 feet at low-water ordinary spring-tides, has, with the exception of a few spots of 19 feet, been realised. The completion of this valuable channel, now so near at hand, into our great naval arsenal, cannot be overrated. During the great wars, and indeed up to 1863, a line-of-battle ship was obliged to discharge her guns to proceed from Spithead to Portsmouth harbour: now any ship, drawing 25 feet, can enter at 3-hours' flood, and the heaviest draft ship at high-water.

*East Coast of Ireland.*—Staff-Commander Kerr and staff, in a small hired steamer, have made a patient examination of the off-lying shoal banks between the Tuskar rock and Wicklow Head. The changes that have taken place in these banks, since their survey in 1844 by the late Captain Frazer, have been of sufficient importance to navigation to demand this re-survey, and necessitate their re-buoyage, a work about to be performed by the Commissioners of Irish Lights.

An examination of the bar at Wexford, Kingston harbour, the bar of the Liffey river, and the new cutting through the bar of Lough Carlingford, formed also a portion of the season's work. Gratifying marks of improvement present themselves in the two last-named localities. The bar of the Liffey has now 15 feet at low-water springs over a breadth of two cables, and a narrow lane of  $17\frac{1}{2}$  feet. In 1800, the greatest depth was but  $5\frac{1}{2}$  feet; in 1856, 13 feet. Lough Carlingford bar, with its cutting of 400 feet wide, and a depth of 18 feet, opens up a fine harbour. A line of steam-vessels now run to the new harbour works and railway at Greenore on the west side of the lough.

*Mediterranean.*—Commander Wharton, in the *Shearwater*, commenced the season's operations on the east coast of Sicily, the survey of which was completed, including a plan of Taormina. An

examination of the north coast between Castel-le-Mare and Milazzo followed, including partially-executed surveys of Palermo bay and Ustica. Port Said and its approaches were also re-sounded in May, 1873. Deposit was found to have taken place around and outside the breakwaters, in certain places considerably, while in others the depth had slightly increased.

The necessity for improved surveys of the dangerous coast in the neighbourhood of Zanzibar—consequent on the increase in number of our ships-of-war engaged in the suppression of the slave-traffic—led to the *Shearwater* being transferred from the Mediterranean to meet these pressing hydrographic requirements.

*Red Sea.*—An important addition during the past year has been made by an exhaustive survey, on the scale of 4 inches to the mile, of the Island of Perim and its off-lying shoals, together with the small strait and the coast near Cape Bab-el-mandeb. The necessity for minute surveys in channels principally navigated by steam-vessels is apparent in this case. A valuable steam-ship was wrecked off the south-east end of Perim in 1872; by general report it was assumed that the unknown danger on which the vessel stranded was several cables' length from the land, and thus a formidable obstacle to secure navigation in a strait only  $1\frac{1}{2}$  mile wide. The survey by Lieutenant Gray and the officers of H.M.S. *Nassau*, while on a passage to Zanzibar, places this danger, still marked by the wreck, just 387 yards from the south-east point of Perim. This tendency to “cut off corners” in steam-navigation is fraught with danger. The most carefully conducted hydrographic survey, in localities newly opened up to commerce, can scarcely be accountable for a lurking pinnacle rock or boulder stone so near jutting points of land.

*East Coast of Africa.*—Reference has been made to the pressing necessity for more accurate surveys of the dangerous line of coast on which the slave-traffic exists, and of the removal from the Mediterranean of H.M.S. *Shearwater* to perform this duty. Commander Wharton has completed the coast of Zanzibar Island and the mainland opposite, from Pungany bay southwards to Pouna point, as also the channels north and south of Zanzibar Island, with their numerous dangers. These surveys are now on their way to England; the *Shearwater* having in the mean time, owing to the sickness of her ship's company, and damages sustained to the ship in examining the intricate dangers of the district, proceeded to the Cape of Good Hope to refit and recruit.

Lieutenant Gray, with a staff of well-trained officers, has proceeded in H.M.S. *Nassau* (commissioned at Malta at the close of last year), to survey the coast southward of Zanzibar, extending from Quiloa to Port Mozambique. Operations have just been commenced, after having carried a line of deep soundings from Cape Guardafui to Zanzibar.

*West Indies*.—Staff-Commander George Stanley and staff, in a hired schooner, have been engaged on the south coast of Jamaica. The chief operations of the survey were the charting and sounding off to the 100-fathom line the coast between Port Royal and Morant point—a work of difficulty, owing to the fierce trade-winds which usually blow in this district. In the latter part of 1873 yellow fever, of a malignant type, broke out at Kingston and Port Royal. Many deaths ensued, and among the victims was a promising young officer, Navigating-Lieutenant Thompson, attached to the survey.

*Newfoundland*.—Navigating-Lieutenant William Maxwell and party, in the hired steam-vessel *Gulnare*, have been actively engaged in various localities. On the south coast the survey progressed 20 miles to the eastward. A re-survey of Port Hood in Cape Breton Island, owing to great changes in the depth of water in certain parts, was made at the request of the Government of the Dominion of Canada. The coast of Labrador from Cape St. Lewis to the latitude of 54° N. was also examined, the prominent head-lands fixed, and outlying islands surveyed. The short time during which this survey can be profitably prosecuted makes it an arduous service. The difficulties of the season's work at the beginning were further enhanced by the immense number of icebergs aground along the shore.

*Japan*.—The survey of the coasts of Kiusiu and Nipon is about to be resumed by Captain St. John in H.M.S. *Sylvia*. This ship was commissioned for the service in February of the present year, and has, therefore, not yet reached the ground for surveying operations.

*Australia*.—The marine surveys of the shores of the several colonies are steadily progressing, supported, as heretofore, by Colonial and Imperial funds.

*In Western Australia*, Navigating-Lieutenant Archdeacon and his assistant have surveyed, in laborious detail, the entrances and approaches to Cockburn sound, Owen's anchorage, and Gage roads, with the view to certain harbour-works in the interests of the colony. The service on this exposed coast in whale-boats, by which

slender means the duty was accomplished, is worthy of record. The party have now completed the northern and western approaches to Swan river, and are about to proceed to the small, but rising, port of Champion bay.

*In South Australia* Staff-Commander Howard and staff have completed the soundings off the southern shores of Kangaroo Island. In Spencer's gulf several islands and dangers seaward of Port Lincoln were examined and soundings in detail taken. The coast-line from Cape Catastrophe to Point Avoid, the inner waters of Coffin's bay, and the sea-coast thence to Point Drummond, have also been surveyed. Soundings off the wild line of coast westward of Cape Catastrophe are now in progress.

*Victoria*.—The surveying party under Staff-Commander H. J. Stanley have been chiefly employed in completing the coast-line of King Island at the western entrance of Bass strait, and in sounding around. The bank of soundings, extending seaward from King island in the direction of Portland bay, was found to extend 30 and 40 miles from the coast, and then to drop suddenly to depths greater than 150 fathoms. This bank of soundings should afford material aid to the navigator making the land in thick weather.

*Queensland*.—Staff-Commander Bedwell, in the hired schooner *Pearl*, aided by a steam launch, is steadily working northward. Port Bowen, Island head, Strong-tide passages, Shoal-water bay, Broad sound, and several islands of the Northumberland group, have been included in the year's survey. Navigating-Lieutenant Connor, detached from the *Pearl*, has been employed surveying portions of the Brisbane river; also the entrance of Endeavour river in lat.  $15\frac{1}{2}^{\circ}$  s.\* (here Cook refitted the *Endeavour* in 1770, after nearly losing the ship on a reef in the neighbourhood). Mr. Connor, aided by a boat and crew provided by Captain Moresby, of H.M.S. *Basilisk*, has surveyed the inner edge of the Warrior reef in Torres Strait, and the adjacent coast-line of New Guinea as far as the Talbot islands.

*Contributions to Hydrography*.—Much varied and useful information, including partial surveys, has been received during the past year from officers both of the Royal and Mercantile Marine.

An useful sketch survey of Amsterdam Island, in the South Indian Ocean, with nautical remarks; as also important corrections to the reef and coast features of Kandavu Island in the Fiji group, Pacific

\* This survey shows a considerable reduction in the depth of water at the river's mouth, and especially in the small anchorage where Cook careened and refitted his ship.

Ocean, have been received from Commodore Goodenough and his Navigating-Lieutenant (Hosken) in H.M.S. *Pearl*.

Captain Moresby, in H.M.S. *Basilisk*, and his Navigating-Lieutenant, T. L. Mourilyan, have largely added to our knowledge of the South-Eastern coast of New Guinea; of which some further details are given in a subsequent portion of this Address, under 'New Guinea.' Between Redscar bay and Point Hood several coast localities were examined, and a detailed survey executed of a capacious harbour, which was named Port Moresby. Proceeding eastward to the comparatively unknown region between New Guinea and the Louisiade Archipelago, these persevering officers succeeded in tracing a clear passage (named China strait) close past the east end of New Guinea, and leading apparently to a clear open channel on the north, named in compliment to the First Lord of the Admiralty, Goschen strait. Captain Moresby, in his homeward route during the present year from the Australian station, where he has performed so much good Hydrographic service, will follow up the exploration of Goschen strait and the northern shores of New Guinea.

In the Eastern Pacific, Lieutenant S. T. Lecky, R.N.R., commanding the Pacific mail steam-ship *Auracania*, has materially added to the secure navigation of the western part of Magellan strait:—by patient observation of the several transit bearings of the various headlands between Cape Cross Tides and Cape Pillar (a distance of nearly 100 miles), made in his several voyages through the Strait; and these again, combined with groups of sextant angles to prominent coast and mountain features at stated distances in the ship's track, have afforded data for connecting the detached labours of P. P. King, FitzRoy, Stokes, and Mayne (1825–1869) in this now rising commercial highway. Mr. Lecky has also furnished valuable notes on parts of the coast of South America between Cape Pillar and Callao, including a clear and neat survey of Tongoy bay, a rising port near Coquimbo.

On the West Coast of Africa, Mr. R. C. Downer, while in command of the *Emily* of Glasgow, on a trading voyage to the oil-rivers in the bight of Biafra, made painstaking surveys of the mouths of the Opobo and Quaebo rivers, heretofore uncharted. With a laudable spirit he presented his labours to the Admiralty, and they are now published.

'Challenger' Deep-Sea Exploring Expedition.—In the Address of my predecessor, last year, the general scope and arrangements of this

expedition were briefly set forth. It mentioned that no expense had been spared to render the *Challenger* perfect in equipment; that an abundant supply of instruments and apparatus necessary to carry out the physical investigation of the deep sea had been furnished, as also all the appliances which modern science could suggest in order to sound, dredge, and obtain the temperature, and other observations at the greatest depths of the ocean.

The *Challenger* had then reached Bermuda, after having visited Lisbon, Gibraltar, Madeira, Teneriffe, and St. Thomas in the West Indies, making continuous lines of deep soundings and temperature observations throughout the several tracks. The subsequent movements comprise a voyage from Bermuda to Halifax by way of the banks off Sandy Hook on the coast of the United States, and the return to Bermuda; thus crossing the Gulf Stream in two widely-spread tracks; thence to the Azores, Madeira, Canary Islands, and St. Vincent, in the Cape de Verde group. From St. Vincent a détour towards the African coast was made, and thence to St. Paul Rocks near the Equator, calling at Fernando Noronha and Bahia; thence to the Cape of Good Hope, touching by the way at the Tristan d'Acunha group.

This completed, or nearly so (depending on the tracks to be made in the homeward route in 1875-6), the Atlantic exploration. To record in the limited space at command all that has been effected in the first part of this excellent work is difficult; a few statistical details will, perhaps, show most readily the great amount of well-directed labour that has been expended in carrying out the leading objects of the expedition.

From the time of leaving England to arrival at the Cape of Good Hope, 18,610 miles of ocean have been traversed. In the deep-sea soundings, 174 casts obtained, and the nature of the bottom ascertained in each case. These casts varied from 500 fathoms to 3875 fathoms, the latter being the greatest depth observed; and, what is remarkable, only 85 miles from the land—that of St. Thomas Island in the West Indies. Of the proportion in number and depths of these deep-sea soundings we have—

In from 3150 to 3000 fathoms, 3 soundings obtained.

„	3000 „	2500 „	36 „	
„	2500 „	2000 „	42 „	
„	2000 „	1500 „	30 „	
„	1500 „	1000 „	37 „	and
„	1000 „	500 „	25 „	desolate

At sixty stations, serial temperatures of the ocean were observed, generally at every 100 fathoms' depth to 1500 fathoms below the surface, the *bottom* temperature being obtained at the same time.\*

At six stations, in depths varying from 3150 to 1000 fathoms, and at twenty stations below the latter depth, the dredge or the trawl was sent to the bottom, and, in most cases, fruitful work for the naturalist was obtained.

Geographical and physical science have rarely received contributions of wider significance and importance than those derived from the *Challenger* Expedition. The reports of Captain Nares on the Atlantic Ocean exploration have been printed by the Admiralty and circulated among learned bodies and individuals as well as among those interested commercially in deep-sea telegraphy. The salient matters touched on in these reports may not prove uninteresting in this Address.

With reference to depth, the greatest found—

In the North Atlantic Ocean was .. ..	3875 fathoms
„ South Atlantic Ocean .. ..	2650 „

With reference to temperature, the lowest observed at sea-bottom was—

In North Atlantic [3025 fathoms] ..	34°·4 Fahrenheit
„ Equatorial Region [2475 fathoms]	32°·4 „
„ South Atlantic [2325 fathoms] ..	32°·9 „

In the North Atlantic Ocean the most striking temperature results are, (1.) that below the upper 60 or 80 fathoms, all the water, as far north as the 40th parallel of latitude, is *warmer* than that at the same depth at the Equator. [A slight exception to this general law was found at Bermuda.]

(2.) The mean temperature of the upper 1500 fathoms is  $4\frac{1}{2}$ ° warmer than that at the Equator.

(3.) The temperature of the bottom water is about 35° (ranging from 35°·6 on the African to 34°·9 on the American side of the Atlantic), while at the Equator it is 2°·6 colder.

(4.) At the Equator the temperature decreases rapidly with the depth. At 60 fathoms below the surface the temperature is the same as at Madeira, with the same depth, namely, 61°·5.

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\* The whole of the soundings given above, and also the serial temperatures, were successfully made with specially prepared hempen sounding-line. This line is one inch in circumference, has a breaking strain of about 15 cwt., and weighs  $18\frac{1}{2}$  lbs. the 100 fathoms. The bottom temperatures were obtained during the sounding operation. The serial temperatures were obtained with the same description of line, but by a separate observation.

From a position 260 miles north of St. Thomas, and thence to the Gulf Stream, a distance of 1000 miles, a warm stratum of water (of temperature 62° to 66° Fahr.) underlies that affected by solar heat and other causes. With a maximum thickness of 380 fathoms—or 330 fathoms thicker than the corresponding stratum southward—the same warm stratum was found to extend within 280 miles of the Azores, when it is suddenly lost. The origin or movement of this immense body of water is obscure; but Captain Nares considers that as its thickest part joins the warmer water of the Gulf Stream, it is evidently connected with it, and probably is an offshoot; also that as the southern and eastern boundaries of this enormous store of heat, extending as it does 2250 miles from the Gulf Stream, and remaining so steadily at the same temperature; it may be safely predicted as being produced by that stream, and to stretch across the Atlantic to the European shores north of the Azores.

With respect to the Gulf Stream, the serial temperature observations show that it is extremely superficial, extending only 100 fathoms below the surface.

Among the notable results of the surface-current observations are the following:—When the Equatorial current was running to the westward on the surface 0·75 knot an hour, at a depth of 50 fathoms the rate had decreased to 0·4; and at 75 fathoms there was still water.

Considerable difficulty—as had been anticipated—was experienced in making sounding and current observations in the Gulf Stream. Captain Nares' Report is of special interest in these practical details. On one occasion, while sounding in this ocean river, the ship had to be steamed at the rate of three knots an hour to keep up to the sounding line.

After refit at the Cape of Good Hope, the *Challenger* sailed in the middle of December (1873) in further prosecution of the voyage of research. The route selected was by way of Prince Edward, Crozet, Kerguelen, and Heard islands; thence southward to the Antarctic Circle; returning northward to Melbourne, Australia—the time occupied being exactly three months, and the distance traversed 7640 miles.

In addition to the several deep-sea soundings made in the solitary seas here traversed, much additional geographical detail was collected of the several groups of islands, more especially at Kerguelen and Heard islands. The *Challenger's* visit to these remote and desolate

spots was of special value in relation to the Transit of Venus Expedition, chosen as they were by British astronomers as the most important stations for their purpose in the South Indian Ocean. The difficulty presented itself as to the security of anchorage for the ships conveying the parties, and for communication between the ships and the latter when engaged in their astronomical duties. Our knowledge of Kerguelen Island, heretofore, was chiefly drawn from the limited survey made by Cook in his third voyage of discovery, in 1776, and from the visit made by Sir J. C. Ross, in 1840, when on his voyage of magnetical research in the Antarctic seas.

Christmas harbour, in the extreme north of the island, which was the chief haven for these two noted expeditions, had thus become classic ground, and was originally selected as the primary station—a second or auxiliary station being destined for Heard Island. Doubts, however, had arisen as to the suitability of the latter wild, outlying mountainous cluster, both with reference to the security of anchorage near its shores and the prevailing climate. To the *Challenger* was allotted the solution of these important questions, and well has it been effected. The entire absence of shelter for the ship, the difficulties that would be experienced in communicating with the observing party, and the slender chance of fine weather, are clearly set forth in Captain Nares' Report of his proceedings. Heard Island has, therefore, been rejected on these grounds as unsuitable. Fortunately the *Challenger's* experienced surveying staff were enabled, during a few days of occasional fine weather in the eighteen days to which their visit was extended, to chart a large portion of the east and south shores of Kerguelen Island. Several good anchorages, at remote distances from Christmas harbour, were examined; and thus a choice of observing stations, with various aspects and various conditions of climate under prevailing winds, are open to the Astronomical Expedition just about to leave our shores. The weather experienced at Kerguelen Island compares with that of England in winter; but, in the favoured parts, the sky is more frequently clear than it is at home in that season.

The full report by Captain Nares on this head will be greatly valued by all interested in this national enterprise.

The secure anchorages taken up by the *Challenger*, after leaving Christmas harbour, were Fuller and Hopeful harbours and Betsey cove in Accessible bay, on the east coast; Greenland bay and Island harbour in Royal sound, on the south coast of the island. A lofty range of mountains runs through the whole extent of the island in

a north-west and south-east direction, with numerous spurs spreading out on each side. The highest peak, which is near the south coast, attains a height of 6100 feet, and was named after the illustrious navigator Ross. Another lofty range, of 3200 feet, near Accessible bay, was named after Crozier, the able colleague of Ross. A central mass whose summit was 4000 feet high, and with a glacier descending to the sea on either side of the island, was appropriately named after one to whom the *Challenger* Expedition is mainly indebted—Admiral Richards.

Quitting Heard Island on the 7th February, the *Challenger's* course was shaped to the s.s.e.: on the 11th the first iceberg was met in  $60^{\circ} 30' S.$ ; and on the night of the 13th, during a fog and light breeze, the ship ran into the edge of the open pack-ice, in  $65^{\circ} 30' S.$ . On the following day the bottom was dredged in 1675 fathoms— $1\frac{1}{2}$  mile from the edge of the pack; in this position numerous icebergs were visible, both in the pack and around, nearly all table-topped. On the 16th the Antarctic Circle, in  $78^{\circ} 20' E.$ , was crossed, the western edge of the pack-ice having been followed since the night of the 13th. At this extreme southern position the weather was “wonderfully clear,” no pack-ice in sight except to the northward, and had there been land of any altitude within 50 miles of the ship in an easterly or southerly direction, it must have been seen.

Working away to the eastward, occasionally in sight of the pack and strong stream ice and many icebergs, a position in lat.  $64^{\circ} 18' S.$  and  $94^{\circ} 47' E.$ , or 20 miles west of Wilkes' Termination-land, was reached, when soundings were obtained in 1300 fathoms—brown ooze—the weather very fine and clear, with no appearance of land in any direction. After experiencing a heavy gale on the following day from the south-east, accompanied with its usual thick weather and heavy snow-squalls—requiring consummate seamanship for the management of the ship, surrounded as she was by icebergs—the *Challenger*, on the 25th, again stood in for the pack, and penetrated a mile within its edge, wishing to get as near Termination-land as possible; while in the pack, and at noon, with a very clear sky to the southward and eastward, and within 15 miles to the westward of the assumed position, there was no appearance of land of any kind.

On the 26th February, when in lat.  $62^{\circ} 26' S.$ , and  $95^{\circ} 44' E.$ , soundings were obtained in 1975 fathoms, yellowish mud; this was the deepest water found since leaving the Cape of Good Hope.

The trawl at this depth brought up numerous specimens of animal life. At the surface the sea temperature was  $33^{\circ}$ ; at 100 fathoms,  $31^{\circ} 9'$ ; at 150,  $34^{\circ}$ ; and at 200 fathoms,  $34^{\circ}$ . Another strong gale with blinding snow was here experienced. Fortunately, just before dusk a large iceberg was seen, the ship was hove-to with a close-reefed spanker and steam up under its lee, and remained in comparative security under this friendly breakwater. A course to the north-east was now shaped, away from this inhospitable region; and, after passing the last iceberg on 4th March, in  $53^{\circ} 17' S.$  and  $109^{\circ} 23' E.$ , the *Challenger* arrived in Melbourne on 17th March.

Notwithstanding the severity of the climate, both in regard to the strength of the wind and the great cold so frequently experienced, 15 ocean soundings were obtained in depths varying from 1260 to 2600 fathoms. Serial temperatures at 13 stations, dredging at 12, and trawling at 6, further followed, the results to the Naturalists of the Expedition having the highest interest.

In the field of terrestrial magnetism, much labour has been bestowed from the time of the *Challenger* leaving England. The elements of declination, inclination, and intensity are daily observed at sea, as well as at the several ports visited. The Magnetic staff includes Commander Maclean, Lieutenant Bromley, and Navigating Lieutenant Tizard, all well-trained and competent observers.

Captain Nares' observations on the ice and climate of the Antarctic Sea passed through in his ship are of interest. He says:

"The icebergs met with by us were usually from a quarter to half a mile in diameter, and about 200 feet high. The highest measured was 248 feet, but it was evidently an old berg floating on a large base. The largest was seen furthest south in lat.  $66^{\circ} 40'$ ; it was certainly three miles in length, and was accompanied by several others nearly as large. They were all remarkably clear of rocks or stones, although, each time we have dredged, sufficient evidence was brought up to show that the bottom of the sea is fairly paved with the débris brought by them from Antarctic lands. In shape they were nearly always tabular, the original top surface of the glacier remaining uppermost, or inclined at a slight angle to the horizon. It is remarkable how few were fallen in with to the westward of the 80th meridian of east longitude, or to the northward of the pack-ice we met there, which I believe to have been a detached patch, similar to that sailed through by Ross in 1841."

"To the eastward of  $92^{\circ} E.$  long. icebergs were very numerous, and continued so as we ran to the eastward, even when we were

at a distance from the pack. Their absence further to the westward, between  $70^{\circ}$  and  $80^{\circ}$  E. long., except when close to the pack-edge, was so marked, that, coupled with their absence on the same meridians in lower latitudes, as shown by the ice-chart, I am led to believe that there can be no land for a considerable distance south in that neighbourhood; and that a very high latitude could be gained there if desired.

“*Temperature.*—When at the pack-edge the temperature of the water was always between  $28^{\circ}$  and  $29^{\circ}$ , just sufficiently warm to melt salt-water ice very slowly, but to have no effect on the fresh-water berg-pieces. At a short distance from the pack the surface-water rose to  $32^{\circ}$ , but at a depth of 40 fathoms we always found the temperature to be  $29^{\circ}$ ; this continued to 300 fathoms, the depth in which most of the icebergs float, after which there is a stratum of slightly warmer water of  $33^{\circ}$  or  $34^{\circ}$ . Whilst in the neighbourhood of the ice, between the 13th and 25th February, the temperature of the air ranged between  $34.8^{\circ}$  and  $21.5^{\circ}$  Fahr., the mean being  $31.5^{\circ}$ ; a slightly colder climate in an average latitude of  $64^{\circ}$  S. than is found in the month of August in the Arctic Seas in latitude  $74^{\circ}$  N.

“*Barometer.*—The barometer ranged between 29.22 and 28.52 inches; when steady at 28.80 or 28.90 inches, fine weather was experienced. It rose quickly to about 29.10 inches the day before the occurrence of each gale, and commenced to fall previous to the wind increasing.

“The gales were also foretold by the unusual clearness of the atmosphere: the first blew from the eastward, shifting to the southward; the second from the northward, shifting to west.

“The prevailing winds were from the eastward. The sky was overcast for seven days out of fourteen; but we obtained sights on all but three days.

“*Whales, &c.*—A great number of fin-backed whales and penguins were sighted whilst we were near the edge of the pack; the former appeared to congregate most on the sheltered bights of the pack. Very few sperm-whales were seen, and no seals or sea-elephants.”

*Summary.*—The usual Tide Tables, Light Lists, and Hydrographical Notices, have been published during the year. Among the larger works are: ‘Red Sea Pilot’ (new edition), from Suez and Akabah to the Straits of Bab-el-mandeb, and thence to Aden. Vol. i. ‘Mediterranean Pilot,’ which contains Gibraltar Strait, Coast of

Spain, African Coast to Gulf of Kabes, together with the Balearic, Sardinian, Sicilian, and Maltese islands. 'South America Pilot,' Part I. (new edition), extending from French Guiana to Cape Virgins, with the Falkland and South Shetland islands. A revised edition of the principal ports on the East Coast of the United States of America; new editions of the 'Channel Pilot,' Part I., and 'North Sea,' Part III.; useful Geographical information, relating to several islands in the Pacific Ocean and to the South-east part of New Guinea, will be found among the Hydrographic Notices.

Among the 77 new Charts published since the last Report, the Ice chart for the Southern Hemisphere deserves notice. This chart, originally compiled in 1866, has since received important additions as to the positions of drifting icebergs, and is now engraved on copper. The movements of the enormous masses of ice thrust out and rent from the Antarctic coasts, as shown on this chart, are worthy the attention of Physical Geographers.

1620 Sheets have received corrections and additions during the past year, and the number of Charts printed for the Royal Navy and the general public has been 187,248.

During the past year the Hydrographical Department, and indeed the Admiralty Surveying Service at large, has, through death and retirement, lost two of its most distinguished members, the Superintendent of charts, Captain Hoskyn, and its esteemed chief, Admiral Richards.

Captain Hoskyn had served long in the regular line of the Naval service as well as on Foreign and Home surveys. With a richly-stored mind, a well-regulated temperament, and unwearied powers of application, he was, fortunately for Hydrography, in 1865, selected to fill the responsible office of Superintendent of charts. By the remarkably efficient and genial manner in which he performed his duties, the esteem and friendship of all those who were associated or came in contact with him in official life, were secured, and few men have died more regretted than Richard Hoskyn.

The loss, through retirement, of Admiral Richards,—who in his position of Hydrographer (extending over a period of ten years, and those years of very stirring times) had secured the respect, the confidence, and the grateful feelings of every member of the Surveying Service,—cannot be over-estimated. That ready appreciation of fellow-workers, devotion to duty, and earnestness for the advancement of Hydrographic science, all characteristics of the man, ren-

dered Admiral Richards a worthy follower of preceding occupants of the office and a bright example to our rising school of Naval officers. The Admiral, in retiring from the post of Hydrographer of the Admiralty, carries with him wishes that he may enjoy many years of fully-restored health, and the assurance that the remembrance of his efficient services to Hydrography and kindly manner to all ranks will not be readily forgotten by his old Staff, ashore and afloat.

INDIAN MARINE SURVEYS.—A most interesting fact, connected with the progress of hydrographical research during the year, is the resumption by the Government of India of Marine Surveys, which have been almost entirely in abeyance since the abolition of the Indian navy, soon after the Government of India was transferred from the East India Company to the crown.

Captain Taylor, of the late Indian navy, has been employed since last year under the Government of India, and has submitted an elaborate review of all existing charts and materials for charts of the coast from Pakchan estuary at the southern extremity of Tenasserim to Sonmiani Bay, west of Kurachee, including all the islands of the Bay of Bengal, the Laccadives, Maldives, &c. He has also matured and submitted to the Government of India a scheme to supplement and perfect existing charts, by working up materials not yet utilized, and by fresh surveys, and has proposed an agency for carrying out his plan, which is now before the Secretary of State.

There can be no doubt that such a plan as Captain Taylor's would not only fill up many a void in our knowledge of these coasts, but would perfect and bring up to date the admirable work which has given to many officers of the late Indian navy an historical name in the annals of hydrographical science. It would carry that work to depths inaccessible to the less perfect mechanical appliances which were available to earlier surveyors, and would help to settle many vexed questions regarding average sea-levels, elevation and depression of coasts, changes of harbour waters, and tidal phenomena of great scientific as well as commercial importance.

It may be hoped that Captain Taylor's plan will be approved of by the Secretary of State, in time to enable him to commence operations early in the next season.

NEW PUBLICATIONS.—*The Indian Directory.*—Connected with the subject I have just mentioned is the East India Directory,

compiled by Captain Taylor, of which the first volume has been published this year. This important compilation, founded on the well-known Directory of the late Captain Horsburgh, has however, been almost entirely rewritten, and copious and valuable additional information given. The latest information regarding the coasts and general hydrography of the Indian Ocean has been patiently and diligently collected and embodied in the work, numerous maps illustrative of the chapters on passages, winds and currents, and the tidal and glacial phenomena, have been introduced, and an entirely new section has been devoted to the Suez Canal route, now daily increasing in importance. The subject of steamers' passages has received due attention, and that of the winds, cyclones, and general meteorology, brought up to the standard of our present knowledge. The book, while containing so much additional matter, has been much reduced in bulk—in itself a great boon to the navigator; a clear type being adopted, with the admirable system of putting the leading words in conspicuous type, long since adopted by the Admiralty. I trust that the author's new duties will not delay the appearance of the concluding volume.

*Petermann's 'Geographische Mittheilungen.'*—This valuable journal still maintains its high position among the serial publications devoted to geographical science. Since the last Presidential Address, many important papers have been produced, recording the progress of exploration and investigation, accompanied by well-executed maps, delineating the country visited by travellers and the results of their observations, or illustrating the physical conformation of the earth's surface, or its divisions for administrative purposes.

The very able articles, referred to by my predecessor last year, upon Arctic geography and exploration, by the editor, have been continued, recording the progress of the various expeditions undertaken by the different European nations and the United States, with the additions to our knowledge of those regions resulting therefrom. These include a description of the various kinds of drift-wood collected on the shores of Nova Zembla, with a view of ascertaining the direction and extent of the currents, the temperatures and physical phenomena observed on board the *Albert*, at Spitzbergen, in 1872; a very complete account of the expedition into Smith's Sound, under the late Captain C. F. Hall; numerous letters from the fifth Swedish expedition, at Spitzbergen, under the

command of Professor Nordenskiöld; and, lastly, a *résumé* of the Arctic campaign in 1873.

Professor Mohn has followed up his previous paper on the temperature of the seas between Greenland and Europe by a valuable essay on the Climatology and Meteorology of the waters surrounding Nova Zembla.

With regard to Asia, several interesting letters from the officers and others of the Russian expedition to Khiva have appeared in the 'Mittheilungen'; Baron Richthofen also records his journey through China, and Dr. Hirth describes the province of Quang-tung; some letters are also published from Captain Prjevalsky, on the Ethnology and Physical Characteristics of Mongolia and Tibet, with a valuable itinerary of the road from Urga to Lassa.

A supplement is devoted to an exposition of the important contribution to our knowledge of the interior of Africa between Natal and the Zambesi, performed by Carl Mauch between 1865 and 1872; and another contains four exhaustive reports on the Physical Configuration, Vegetation, Geological Productions, and the People of the Caucasus, by Dr. Radde, director of the Imperial Museum at Tiflis.

Among other papers on Africa may be noticed a report of a new exploration of the Libyan Desert by Gerhard Rohlfs, Ernest Marno's researches on the Upper Nile, and Dr. Nachtigal's routes on the Bahr-el-Ghazal.

The discoveries of Giles, and Gosse and Warburton in Central Australia, to the west from the line of electric telegraph, are each recorded as far as information has been received. Dr. Bernouilli contributes an interesting paper on a journey in Guatemala in 1870.

The results of the *Challenger* expedition, principally relating to the temperature of the North Atlantic Ocean at various depths, as far as they have been made known, are condensed and illustrated by a map.

*Italy.*—I am indebted to our much-esteemed honorary corresponding member, the Chevalier Cristoforo Negri, for the following details of geographical progress in Italy:

The Military Topographical Institute (the branch resident at Florence of the General Staff, which is stationed at Rome) has continued its geodetic labours with zeal and ability, and now little remains to complete the great fundamental map of the whole of

Italy and Sicily. The map of Sardinia, compiled from the researches and at the private expense of the late General Alberto La Marmor, has not yet been revised. The publication of maps has also continued, great use being made of the method of engraving by photography, introduced by General Avet.

The Royal Marine has confined its labours almost exclusively to the Adriatic (in connection with the Imperial Austro-Hungarian Marine), and the chart of the Gran Cabotaggio, which dates back more than half a century, will be greatly improved. It will then be necessary to think about a maritime chart of Sicily and the West of Italy; the English and French maps leaving much to be desired, as is frequently found to be the case. The geological map is also progressing, though slowly, owing to the want of a staff of paid subalterns. Some provinces (as, for instance, Forli) have published voluminous scientific monographs on their territory. The numerous works and projects for railways and canals have made us better acquainted with the hypsometry of Italy.

The Alpine Club has now its branches in nearly all parts of Italy, and the travels of many of its members furnish valuable, though unconnected and fragmentary, materials for the science of geology.

The botanist Dr. Odoardo Beccari, subsidised by the town of Genoa and the Italian Geographical Society, continues his excursions in the south-east of Malaysia, and in some parts of New Guinea, and sends rich collections to Italy—both to Genoa and to Rome. Concerning the explorations of this indefatigable savant, in New Guinea and the neighbouring islands, I shall give a further account in a subsequent section of this Address.

The Italian Geographical Society is concentrating its resources and preparing to send a scientific expedition to Shoa, where it will receive the support of the Prince of that country, who has sent an envoy to Rome. The expedition would proceed in a westerly or south-westerly direction from Caffa, or Kaffa, into an unknown region. The expedition will be commanded by the naturalist Antinori, who has already visited the south-western affluents of the White Nile and the country of Bogos, and Lieutenant Parent, who accompanied Nordenskiöld to Spitzbergen two years ago.

The Society is continually increasing in numbers, and we may hope that any re-organisation which may be in contemplation will maintain and extend its sphere of usefulness. The actual effective president is Signor Correnti, Councillor of State; and Signor Negri enjoys the title of Perpetual President and Founder;

but every lover of geography will regret that, owing to his absence from Rome, and other causes, he now takes no part in the direction.

ARCTIC EXPLORATION.—The hope expressed by my predecessor that the year 1874 would see the despatch of an exploring expedition to Smith Sound, has, I regret to say, but little chance of being realised. The joint Arctic Committee, appointed by the Royal Society and our own Society, for the purpose of preparing a statement of the valuable results to science that might be expected from such an expedition, held various meetings during the summer of 1873; and on the 6th of November the Council of the Royal Society nominated several of their body to co-operate with us in representing to the Government the desirability, in the interests of science, of such an Expedition. A joint deputation from the two Societies \* to the Government was soon after resolved upon, to which representatives of the British Association and the Dundee Chamber of Commerce were to be added, but in reply to my application to the late Prime Minister for permission to wait upon him, I received the following letter:—

“ 10, DOWNING STREET,

“ 29th November, 1873.

“ MY DEAR SIR B. FRERE,

“ I have now been able to consult my colleagues with reference to the request which you have conveyed to me on the subject of the proposed Deputations from the Royal Society, the Royal Geographical Society, the British Association for the Advancement of Science, and the Dundee Chamber of Commerce, to present Memorials praying the Government to undertake an Arctic Expedition.

“ I must recall to your attention that the Government decided, during the present year, that no further voyage of discovery should be undertaken until the voyage of the *Challenger* should be completed. It was on this broader ground that they decided, and not on the narrower ground only, of the actual state of the particular question of Arctic Exploration.

“ I would remind you that the operations of the survey are at present very incomplete. By survey I mean generally the examination of coasts more or less available for trade and general intercourse. These operations, generally, the Government hold to have a stronger claim than those of discovery: they are prosecuted with as much activity as general considerations of expense will permit; but were Her Majesty's Ministers disposed to augment the charges for Naval Services not strictly professional, they would incline to do so for survey rather than by a new voyage of discovery at the present moment.

“ If it be thought that there are reasons which should induce the Government to alter the decision recently and deliberately adopted, I am obliged to

\* Consisting, on the part of the Royal Society, of Professor Allman, Professor Busk, Dr. J. D. Hooker, Professor Huxley, Mr. Prestwich, Mr. P. L. Sclater, and General R. Strachey; and on the part of the Royal Geographical Society, of Sir Bartle Frere (President), Sir Rutherford Alcock, Admiral Sir George Back, the Earl of Derby, A. G. Findlay, C. R. Markham, Admiral Sherard Osborn and Sir H. C. Rawlinson.

ask the favour that the reasons be presented to us in a written form, when I should have the best and fullest opportunity of considering them in common with my colleagues.

“I remain,  
“Very faithfully yours,  
(Signed) “W. E. GLADSTONE.”

In compliance with the concluding request in this letter, I addressed the Prime Minister as follows:—

“22, PRINCES GARDENS,  
“6th December, 1873.

“MY DEAR MR. GLADSTONE,

“I have to thank you for your letter of the 29th November, and for your kindness in stating so fully the grounds on which it was formerly decided to undertake no Arctic Exploration until the voyage of the *Challenger* should be completed.

“You will, I am sure, pardon me when I say that I do not think the connection between the voyage of the *Challenger* and the proposed Arctic Exploration is very obvious.

“I do not in the least undervalue the probable results of the *Challenger's* voyage. Even so far as they have gone, those results have shown their importance to the ocean navigator, to our submarine telegraphs, and to many branches of science of direct commercial value, apart from the great purely scientific questions which are illustrated every week she is at sea.

“But, except in these latter points of pure science, I know of nothing that the *Challenger* is doing which has much connection with the problems to be solved by the proposed Arctic Expedition.

“As regards immediate commercial results, every shipowner and seaman might find matter of interest in both Expeditions; but while the *Challenger's* results affect mainly the Atlantic and Pacific, and their commerce, the Arctic Expedition, commercially, most interests the great fishery ports, and those engaged in manufactures of Indian fibre, which cannot exist without animal oils.

“We all, commercial men as well as geographers, recognize and lament the very incomplete and inadequate condition of our naval surveying operations. There has been a very slight improvement of late years; but, upon the whole, the means at the disposal of the present able and zealous officer who advises the Admiralty on these subjects are, I believe, less in proportion to the whole naval expenditure than they were many years ago in Admiral Beaufort's time—certainly they are far less than the requirements of our greatly extended commerce demand.

“I gratefully acknowledge what has been done, partly as a result of the late mission to East Africa, in sending surveying ships to the east coast of that continent; but I think you will find there is very little survey work going on anywhere else. I know that in the Indian seas the lamentable deficiency of marine surveying of late years, as compared with some of the magnificent surveys executed more than 40 years ago by the East India Company, are subjects of daily remark by all commercial and nautical men. And on the great highways between Australia, England, India, and China, are large regions, which, for want of surveys, are given up to pirates and man-stealers: whereas, if they were surveyed as New Zealand was surveyed, within a very few years after our flag was first seen in those waters, those regions might be of the greatest commercial value to the whole world.

“You will, I am sure, pardon me for taking exception to the expression in your letter which indicates an opinion that voyages for survey, or discovery

are not strictly 'professional naval services.' I believe that in these days, when it is so difficult to find a seaman's training for our young officers and men, when so much of the work is done by machinery, there are few better naval schools than a surveying ship; and that, if such ships were multiplied, not only would commerce benefit, but your men-of-war would be better supplied with practical seamen, both among men and officers, than is possible at present.

"This is still more the case with regard to any Arctic voyage of discovery. Service in the Arctic Seas, under any conditions, is one of the best possible schools for seamen, and is one of the few schools which now remain by which a thorough seaman can be formed, quite equal to the best men of former days.

"Moreover, as a matter of fact, some of our very best practical officers are men who distinguished themselves in Arctic exploration; and I doubt whether there is a single hour of any Arctic voyage of discovery which, in a strictly professional point of view, may not be considered well spent as training for any naval service.

"In reply to the kind invitation with which your letter concludes, that I should submit to you in written form the reasons which seem to us sufficient to induce the Government to alter its decision to postpone all Arctic discovery until the voyage of the *Challenger* is completed, I venture to forward some papers which I had intended to place in your hands as explaining, in more detail, the grounds of our application:—

"1. The first is a description of the several deputations who wish for the honour of an interview.

"2. The second is a Report of the Arctic Committee of the Royal Geographical Society.

"3. The third is a memorandum drawn up by that Committee for the Arctic Committee of the Royal Society; and

"4. The fourth is a brief sketch of the general grounds of the application of the Royal Geographical Society.

"The following are, shortly, the reasons why we urgently request that you will do us the favour to fix an early day for the reception of the deputation:—

"First, because any preparation for an expedition to sail in 1874 ought to be commenced at once.

"Secondly, because the several scientific and mercantile bodies represented by the deputations naturally expect that their reasons for a naval Arctic Expedition may be considered before a decision is finally formed; and though the papers enclosed state most of the arguments of the Royal Geographical Society, I cannot undertake to state all the reasons which might be urged by those members of the Council who are practically acquainted with Arctic discovery. Nor can I anticipate the special grounds which might be urged by the Royal Society, the British Association, and the Dundee Chamber of Commerce.

"Thirdly, that, even if her Majesty's Government should finally decide that the expense cannot be included in the Estimates now under preparation, the questions we would beg you to consider by no means end there. I have reason to know that at least in two quarters there is a very strong disposition to undertake as a private enterprise what I cannot but consider ought to be a national work; that very considerable sums will be risked in the attempt, partly on commercial grounds, partly as an expression of what I believe is a very wide-spread feeling on the part of the public who interest themselves in such questions.

"I may add that I am personally opposed to entrusting any such work to private hands; not on account of the expense, which I calculate could never, even if everything were done on the most liberal scale, exceed 25,000*l.* per annum;

but because I consider the object of such national importance that the work ought to be undertaken by the nation; and because the risks, which I believe are very small to a well-appointed and well disciplined Government expedition, are much increased if entrusted, as in the case of the *Polaris*, and of many other less successful expeditions, to men who are not under naval discipline or control. And, lastly, because the risk and difficulty in the first instance will be enhanced by a private expedition, without any certainty of saving any ultimate cost to Government. I look upon failure as far more likely to result from the private expedition than from one undertaken by the Admiralty, and I do not see, in the event of any disaster overtaking a private vessel, how it will be possible for the Government to avoid the expense of subsequent expeditions to look for her and her crew, after the experience we had in Franklin's case, showing that if the survivors of the expedition had been promptly looked for, many—probably most—of them might have been saved.

"I have little doubt that, should we not succeed in altering the views of Government as expressed earlier in the year, the Government will be applied to to aid an expedition under private auspices, and more or less at private expense. This would place the question in a position which, to my mind, would be less satisfactory than if Government undertook the whole expense.

It is true that, if the funds were supplied by private individuals, Government might concede the commissioning the ships, so as to place the expedition under naval discipline; but to my mind it is not desirable to allow any authoritative interference by private parties, which it would be difficult to prevent unless the whole is under the unquestioned control of the Admiralty.

"May I submit that much time and trouble might be saved to her Majesty's Government, if you would consent at an early date to hear the arguments of the several deputations. Any delay till after Her Majesty's Ministers separate for Christmas may be productive of serious inconvenience and loss, especially should any private expedition be attempted too late in the season to go out fully equipped.

"Believe me, dear Mr. Gladstone,

"Ever yours faithfully and sincerely,

"H. B. E. FRERE.

"The Right Hon. W. E. Gladstone, M.P."

The change of Ministry, which occurred not long after this letter was written, has delayed any further steps being taken in reference to this important subject. But the Council propose to bring it again before the present Ministers, and hope to obtain a favourable hearing. I should do injustice to Mr. Gladstone were I not to mention the strong personal interest he takes in expeditions of Arctic Discovery—an interest which does not seem to have diminished since, in 1834, he took an active part in the Select Committee of the House of Commons, which expressed so high an opinion of the national importance of Arctic Exploration, and of the valuable service which Sir James Ross had rendered by its promotion. In other directions the past year has not been an active one in Arctic projects. We have not received the official account of the remarkable voyage of the *Polaris*, up Smith Sound, of which a brief sketch was given in last year's Address. But an excellent résumé of the geographical

information brought by the American Expedition was given by our Secretary, Mr. Clements R. Markham, on the first evening of the present Session, in a paper in which he also communicated the results of the voyage of his relative Captain Markham, R.N., in the *Arctic*. The interest in this department of geography may be said now to centre in the fate of the Austrian Arctic Expedition under Payer and Weyprecht, which sailed in June, 1872, in the direction of Behring's Straits by way of Nova Zembla, and which has not been heard of since Count Wilczek left the gallant little party on the shores of Nova Zembla in the month of August of the same year. Attempts will no doubt be made, during the present summer, to obtain tidings of this Expedition; and I may mention that this is one of the objects of the journey of our Associate, Mr. Joseph Wiggins, of Sunderland, who has sailed in the yacht *Diana* for a summer's cruize in the Spitzbergen Seas.

ASIA.—*Palestine Survey*.—Major C. W. Wilson, R.E., Director of the Topographical Department of the War Office, has furnished me with the following account of the progress of the Palestine Survey, in continuation of that given in the Address of last year.

The Survey of Palestine which is being made, on a scale of 1 inch to a mile, for the Palestine Exploration Fund, by Lieutenant Conder, R.E., Mr. Tyrwhitt Drake, and three non-commissioned officers, R.E., from the Ordnance Survey, has made considerable progress during the year that has passed; 1750 additional square miles have been completed and the finished map now extends from Nazareth to Bethlehem, and from the sea to the Jordan, covering an area of over 3000 square miles.

By the middle of June, 1873, the survey had been carried down the coast from Carmel towards Jaffa; but, in consequence of the great heat, this portion of the work could not be completed, and the party were obliged to retire to Bludan, in Anti-Lebanon, where they remained from July to October. From Bludan several excursions were made; the principal one being to Mount Hermon, where a number of observations for latitude were taken, and the true bearing of Carmel and other points in the survey determined. In October work was resumed in the south of Palestine, and by the end of November the survey had been carried down to the northern end of the Dead Sea and the mouth of the Jordan. In December a very severe outbreak of fever in the camp necessitated a removal to Jerusalem, where the party were delayed till the beginning of

March by the extraordinary severity of the weather, which prevented all work in the field; but as soon as the weather moderated they returned to the Jordan Valley, and carried the survey northwards to within two or three miles of the Sea of Galilee. This section of the work is of special interest, for it has given us, for the first time, a correct representation of the topographical features of the western side of the Jordan Valley, and an accurate survey of the windings of the Jordan; a number of salt-springs were found at different points of the valley, and attempts were made to register the variations in the level of the Dead Sea by means of a wooden gauge, but unfortunately the gauge was destroyed by the Bedawin. In April the portion of the Maritime Plain left unsurveyed in the summer of 1873 was completed, and the party then retired to Jerusalem to continue the plotting and drawing of the fair plans.

Lieutenant Conder has recently returned to England, bringing with him three sheets of the survey, which contain about 1600 square miles, in a finished state, including hill features. The survey sheets are accompanied by seventy large scale plans and special surveys of important places, such as Cæsarea, Beisan, &c.; two volumes of MS. notes, containing detailed measurements of every important ruin in the country, with a description of each, written on the spot; lists of all names, written in Arabic and English, and arranged alphabetically for each sheet; and about fifty water-colour drawings of places of Biblical interest, studies of figures, animals, &c.

A geological map of the district survey has also been prepared, and specimens collected.

Lieutenant Conder returns to Palestine in July, and hopes to complete the survey of Western Palestine from Dan to Beersheba, in the same thorough manner as the work which he has brought home, during the winter season of 1875-6.

Of the American expedition, under Lieutenant Steever, U.S. Engineers, we have but slight information; after measuring a base line on the Plains of Moab, near Hesban, and completing the survey of about 500 square miles of country, the expedition returned to America, but no account of its labours has yet been published. It is believed that a second expedition is now being organised in America to continue the survey east of Jordan during the winter of 1874-5.

The completion of Mr. Murray's Map of Palestine by the publication of the southern sheet during the past year should not remain.

unnoticed. Carefully compiled, and well engraved, the map is far superior to any previous Map of Palestine, and cannot fail to be of great assistance to all students of Biblical geography.

*Persia*.—Last year Colonel Valentine Baker and Lieutenant Gill, R.E., travelled from Tehran to Meshed, and thence northwards by Kilat to Mahmoodabad, and round by Koochan, Shirivan, Bujnurd, and Jajarm to Shahrud and Tehran. The journey was for a considerable distance over a new country, and has added much to our knowledge of the district north of Meshed and around the head waters of the Attrek and Giurgen.

A reconnaissance of the route followed, with astronomical observations at certain points, was made by Lieutenant Gill, and since his return to England the work has been laid down on a scale of 4 miles to 1 inch, and the reconnaissance embodied in a general map of the north-eastern frontier of Persia, on a scale of 20 miles to 1 inch.

*Russian Empire and Mongolia*.—An expedition of a remarkable and enterprising character has been accomplished, under the auspices of the Imperial Geographical Society, by Captain N. M. Prjevalsky, of the Staff Corps, who travelled for nearly three years in the most remote parts of Inner Asia. For a considerable time—viz., from the spring of 1872 to the end of the summer of 1873—M. Prjevalsky was entirely cut off from all intercourse with the civilised world. The expedition was composed of Captain Prjevalsky, Lieutenant Pyltseff, and two Cossacks. Starting from Peking, he first travelled through Chakhar Mongolia, as far as the northern bend of the Yellow River, whence, crossing the desert of Alashan to the neighbourhood of Sining,\* at that time disturbed by a revolt of the Dungans, he visited Lake Koko-nor, and arrived on the northern borders of Thibet at the Upper Yang-tsze-Kiang or Mourou-iussu. Undaunted by the difficulties and dangers of the journey, M. Prjevalsky and his companion travelled 11,000 versts (7300 English miles), 5300 of which have been projected on the map,† with the aid of a route-map, based on 18 positions astronomically determined. The scientific results of this expedition are most important, including a number of hypsometrical and meteorological observations, and a valuable collection in Natural History. The labours of M. Prjevalsky serve to supplement Huc's description of the Tsaidam

\* M. Prjevalsky was 60 versts (40 miles) to the east of Sining at Chobseng.

† It is to be regretted that the observations taken by M. Prjevalsky do not include the longitude as well as the latitude of the places he visited.

country and Kan-su, besides acquainting us with the fauna on the banks of the Mouroui-usstu and the tribes inhabiting Koko-nor, Alashan, Kan-su, and Amdo. On comparing these travels with the works of Chinese \* authors, and with an itinerary from Urga to Lhassa, communicated by M. Shishmareff, as well as with the travels of Mr. Ney Elias through Western Mongolia, we find excellent materials for correcting our knowledge of the geography of this part of Asia, which was hitherto based on the surveys of the Jesuits in the eighteenth century. For further details regarding this important exploration, I may refer to Mr. Ney Elias' annotated account of them in No. 1 of the present volume of our 'Proceedings.'

Dr. Fritsche, the Director of the Peking Observatory, has lately travelled through Eastern Mongolia, on his way from Peking to Nerchinsk in Eastern Siberia, on a visit of inspection to the meteorological station at the latter place. Entering Mongolia by one of the northern passes leading from China, he diverged from his direct road in order to explore the south-eastern border of Mongolia. He found by hypsometrical observations that the general elevation of the country did not exceed 600 to 1550 mètres (2000 to 5000 feet), and that the height of some of the highest mountains was not more than 2000 to 3000 mètres (6500 to 10,000 feet). Dr. Fritsche's observations prove the incorrectness of the statements of the Jesuits, according to which Peh-cha is described as a mountain 15,000 feet above the sea-level. Indeed the Chinese, who were questioned by M. Fritsche as to the presence in that country—especially in Wei-chang—of a mountain which attained the level of the snow-line, invariably answered in the negative; and declared that they had never heard of the name of Peh-cha. After visiting Hailar, the trade centre of North-Eastern Mongolia and Trans-Hingan Manchuria, Dr. Fritsche entered Russian territory at Tsurukhaitu. He describes that part of Mongolia visited by him as steppe-like, thinly populated, with lakes and rivers gradually drying up. He has since arrived at St. Petersburg, from which city he sent us in March last a copy of his map of East Central Asia, in which all the geographical and hypsometrical observations made by recent Russian travellers have been utilised.

In Northern Mongolia we have to notice an expedition by M. Paderin from Urga to Uliassutai, with the special object of dis-

\* Translated by Father Palladius and M. Uspensky, see the 'Proc. of the Imp. Geog. Soc.' for 1873.

covering the ruins of Karakoram, the exact position of which is unknown. The itinerary of M. Paderin contributes to the geography of the basins of the Orkhon, the Upper Selenga, and the steppe-rivers flowing north and south from the Khankai-ola Mountains.

North of Paderin's route another journey has been made by the enterprising merchant Veselkoff, who travelled from the district of Minusinsk, in Siberia, to the Chinese outpost of Dzindilik, on the Upper Tess, and afterwards through an unexplored country to Kossogol. His remarks on the country of the Upper Selenga and its Mongol inhabitants are worthy of attention. M. Veselkoff was the first European to visit the Chinese post at Agar, and the stake fence dividing the lands of the Mongols from those of the Darkhats.

The south-eastern branches of the Altai Mountains, the valley of the Black Irtish, and the basin of Lake Uliunghur, have been explored by MM. Sosnoffsky, Miroshnichenko and Matusoffsky. M. Sosnoffsky discovered that no actual hydrographical connection exists between Lake Uliunghur and the Black Irtish, although he believes that this lake once belonged to the oceanic basin when the river flowed out of the lake; afterwards, probably owing to some gradual change, the lake became confined in a separate continental basin. The Irtish now flows at a distance of only two or three versts ( $1\frac{1}{4}$  to 2 miles) from the lake; the whole of its eastern shore is known by the name of the heights of Tsir Guntai—the bare, gravelly plain, strewn with pebbles and shells, and covered with frequent salt marshes, bears the unmistakable appearance of having been recently submerged; and there is still a tradition among the inhabitants that the body of Uriankhai, who was drowned in the lake, was afterwards found in the Irtish. Sosnoffsky also collected information upon the course of the Black Irtish, and was the first to correct the wrong impression hitherto prevailing about that river, which represented it to be a wide deep stream with a rapid current. Its greatest width is at the mouth of its tributary, the Kaba, where it forms a bay 100 fathoms wide. Below the Kaba, *i.e.*, towards Zaisan, its width is from fifty to sixty fathoms. As to its depth, the river is only unfordable immediately

after the spring floods, about the 25th March  
6th April; at any other time  
there are plenty of fords, and they are particularly frequent above  
the mouth of the Kaba. Thus the river is only navigable as far as  
the Kaba, and only light craft can ascend higher. We also find,

from these researches, that the basin of the Black Irtish slopes gradually towards the west, and is bounded on the north by the Altai Mountains, while to the south rises the Saura, a range unknown till quite recently, but in which there are peaks attaining a height of 12,000 feet above the level of the sea. Cartographen are indebted to the observations of MM. Matusoffsky and Mironnichenko for new materials for correcting their maps of the country adjacent with the Black Irtish and Lake Uliunghur. Of especial value is the astronomical position of Bulun-Tokhoi, by means of which a projection can be made of Morozoff's caravan-route from the Upper Irtish to Khobdo, Uliassutai and Barkul.

In another part of the Chinese Empire, bordering on Russian Manchuria, Lieut.-Col. Barabash, of the Staff Corps, has recently made an interesting journey. Ascending the Sungari, to the mouth of the Nouni, he made his way up this river to Tsitsikhar, the capital of Northern Manchuria, whence he descended both rivers to Sansing, at the mouth of the Hurka; followed the course of the latter river up to Ninguta, and then, crossing the mountains to the basin of the Suifin, terminated his long journey at Nikolsk.\* His journals, which will soon be published, will contain some new facts relating to this almost unexplored country, and will therefore be of exceptional interest to geographers.

Turning from the borders of China to Asiatic Russia, we have to notice an interesting expedition, organised and equipped by the Imperial Geographical Society under the command of M. Chekanoffsky, assisted by MM. Müller, Ksenjopolsky, and Nachvalnich. Some accounts of the Lower Tungusska Expedition have been published in the 'Proceedings of the Russian Geographical Society,' to which reference should be made by all who are desirous of acquainting themselves with the details of this scientific mission. We can only notice it briefly here. Early in the spring of 1873, the members of the expedition assembled in the district of Kirensk, and, as the severity of the climate would not allow of an immediate start, they employed the time in the meanwhile in scientific excursions in the basins of the Lena and Upper Tungusska. In the end of May they embarked in a boat for their voyage down the Lower Tungusska River. Müller made astronomical and magnetic observations, Ksenjopolsky attended to the collections, the topographer Nachvalnich kept an itinerary, noting the names of the places

\* Nikolsk must not be confounded with Nicholaieffsk at the mouth of the Amur.

according to the local nomenclature, with the assistance of a native guide, while the leader of the party studied the geology of the country. Some of the collections of Chekanoffsky have been received in St. Petersburg, and the other results of his labours, as well as those of his companions, are in the course of publication. Towards the end of December last year Chekanoffsky and Müller started on another expedition to Olenek: their route will lie along the Upper Tungusska, and afterwards through a country part of which is entirely unexplored.

The military expedition last year to Khiva led to some important geographical results, which are in a great measure due to the zealous co-operation of General von Kaufmann, Governor-General of Turkestan, and General Krijanoffsky, Governor-General of Orenburg. It was at the instance of the former that the Imperial Geographical Society framed a list \* of instructions to guide and assist scientific explorers, who might accompany the expedition, and furnished them with the necessary instruments for taking observations. Among the most recent accessions to our knowledge of the Oasis of Khiva, and the Aralo-Caspian Plains, we will notice the reports of Kuhn and Krause, the magnetic observations of Ovodoff, and the astronomical observations of Sirovatsky, the specimens of water drawn from the Aral Sea by the commander of the flotilla, and the fossils found by Dikhoff on the banks of the Amu Daria. Of especial interest also are the researches of M. Bogdanoff, a young naturalist of great promise, who accompanied the expedition to Khiva, and brought home a collection of fish from the Amu Daria. Glukhoffsky's researches below Kunia Urgendj, along the old bed of the Oxus, complete the survey of the whole extent of the Usboi, the lower part of which, from Igdy and Ortakui to Balkhan Bay, had previously been explored by Stebnitzky. The latter officer has recently been engaged in some topographical work in the Turkoman Steppes, south of the Usboi, and has determined twenty-one positions astronomically, besides taking numerous hypsometrical observations.

In European Russia MM. Chaslaffsky and Barkoffsky, known for their researches, the former in the Moscow region, the latter in that of the Niemen, have collected statistics relating to the corn-trade in the Azoff-Don country, from which it appears that the large increase † in the export of corn from the ports of the Sea of Azoff is

\* These instructions were prepared by a committee of the Geographical Society, and were distributed among all three detachments.

† The exports from the ports of the Sea of Azoff increased from 20,000,000 in 1865 to 70,000,000 in 1871, and 90 per cent. of the exports were cereals.

caused by the vastly extended area of cultivation, owing to the development of railways, and new laws for the tenure of land in the country of the Don Cossacks. Lastly, in concluding this brief summary of Russian geography during the past year, I must allude to the labours of MM. Mainoff and Poliakoff in the government of Olonetz; the remarks of the former on the traces of the glacial period, and of the latter on the sectarian population in the district of Onega, are worthy of attention.

In the prospective arrangements for the coming season, Russian geographers are displaying great activity. An expedition has been organised by the Imperial Geographical Society to explore the delta of the Amu Daria and its different channels, to establish two meteorological stations on its right bank, and to ascend the course of the river as far as circumstances may permit, in order to ascertain how far it is navigable. Another party will execute a series of levellings in the Aralo-Caspian plains, determining with accuracy the difference in the levels of the two inland seas. An exploring party, under Captain Glukhoffsky, will make further researches in the Usboi or old bed of the Oxus, while a third party, under the auspices of the Society of Naturalists attached to the University of St. Petersburg, amongst whom are MM. Bogdanoff and Barbot de Marny, will visit the elevated plateau of the Ust Urt. We also hear of scientific expeditions to the southern spurs of the Thian Shan Mountains in the direction of Kashgar and to the mountainous region east of Lake Issyk-kul.

*Indian Land Surveys.*—According to the official Report, the work of the Great Trigonometrical Survey during the year 1872-73 consisted of 92 triangles, covering an area of 11,058 square miles with the great theodolites, and of 3224 square miles, closely covered with points for the topographical surveys, with smaller theodolites; while several points have been fixed over an area of 7290 square miles of a portion of the Himalayas, inhabited by independent tribes, which will be valuable for preliminary geographical requirements. An area of 2734 square miles has been topographically surveyed in the Himalayas on a scale of 1 inch to the mile, and an area of 3878 square miles, on the 2-inch scale, in the Bombay Presidency.

Among the more salient points of the survey are the completion of the “Bider series,” a longitudinal chain of triangles extending from Bombay to Vizagapatam, through one of the most unhealthy parts of India, which has been effected by a party under the com-

mand of Mr. W. C. Rossenrode; the continuation of the Assam operations, in the midst of extraordinary difficulties, by Mr. W. G. Beverley; the resumption of work at the Mangalore meridian series by Major Branfill; and the Brahmaputra survey by Captain Carter. In Kumaon and Gurhwal the survey has been under the direction of Lieutenant I. Hill, R.E., who last year carried on operations in the Mána valley, in the lake country to the east of Naini Tál, in the country round Lohur Ghat, in the portions of the Gori and Ramganga valleys near Arkot, and in the Bhabar parganahs. Much of the 2734 miles surveyed during the year by Lieut. Hill's party was between 10,000 and 25,000 feet above the sea-level.

With regard to the Topographical Survey, seven parties have been in the field during 1872–73, as in the previous year. The total amount of work done was 25,327 square miles of final topography, only 6136 of which were in British territory, the remaining 19,191 being in native states. The tracts thus explored were for the most part wild and unhealthy; and those in Bilaspur, Mandla of the Central Provinces, the Garo, Naga, and Northern Chittagong hills, were covered with forests; in parts uninhabited, and never before entered by a European. An account of the operations in the Garo district, replete with interesting and valuable information with regard not only to the topography and physical configuration of this wild region, but also its geology and natural history, has already been communicated to our Society by the officer in command, Major Godwin-Austen, and published in our 'Journal. There were, however, four parties engaged at the same time in completing the surveys of this region, comprising the Northern Chittagong hill-tracts, the Tipperah, Lushai, and Cachar hills, the Garo and Naga hills, and the Northern Munipur frontier. The various portions of this wide district were allotted to Major Godwin-Austen, Captain Badgley, Mr. Cook, and Lieutenant Woodthorpe. Altogether, 11,273 square miles were surveyed by these detachments. In Rajputana, 2760 square miles were delineated topographically by Captain Strahan.

Great progress was made during the year in the drawing and compiling branch of the head-quarter office of the Survey, under the energetic superintendence of Mr. I. O. N. James, in reducing, compiling, and incorporating the latest survey results on the original sheets of the Indian Atlas. Nine new quarter-sheets have been taken up, and considerable additions have been made to eleven of the old full-sized sheets. A great number of other maps

have also been completed, or are in progress. In the photographic branch, Captain Waterhouse, who has charge of this department, reports that 1611 maps have passed through his office during the year.

The Revenue Surveys have been continued during the year; four Cadastral Surveys being now at work in the North-West Provinces. The Annual Report of the Geological Survey has been this year drawn up by Mr. H. B. Medlicott, the accomplished colleague of Dr. Oldham, the founder of the Survey, who was absent on sick-leave in Europe for the first time during his twenty-two years' service. Dr. Stoliczka, another colleague, joined the Kashgar Mission party under Mr. T. D. Forsyth; and after taking part in various explorations carried out during the stay of the Mission, died on the return journey to India. The loss of this able public servant and zealous naturalist is much to be deplored.

*Central Asia.*—The most important additions that we have received during the past year to our knowledge of the geography of Central Asia have been furnished by the Mission which Mr. Forsyth has conducted to the Court of the Ataligh Ghazee. An account of these has been given to the Society at so recent a period as our last evening Meeting, by Sir Henry Rawlinson, to whom I am indebted for the brief résumé I now give you. Mr. Forsyth's Mission, although primarily constituted for political purposes, was also admirably equipped in respect to the interests of science; Colonel Gordon, with his coadjutors, Captains Biddulph and Trotter, and Dr. Stoliczka, forming perhaps as efficient a party as the whole of the Indian services could furnish for the exploration and investigation of an unknown region. As far as Kashgar the labours of the Engineer officers were mainly directed to the verification of the previous observations of Messrs. Shaw and Hayward, but beyond that point they entered on an entirely new field of operations. Colonel Gordon first led his party to the Chadir-kul Lake, about 100 miles to the north of Kashgar and within the Russian frontier, thus for the first time joining the two great systems of survey which have been so long at work in the north and south of Asia. We can well understand, indeed, the feeling of honest exultation with which Captain Trotter, who represented the Great Trigonometrical Survey of India with Mr. Forsyth's Mission, announces that "the scientific operations of Russia and England have now crossed each other in

friendly rivalry, the road from Kashgar to the crest of the Thian-shan (or Celestial Mountains) being a link in the chain across Asia, common to both countries."

Colonel Gordon found the crest of the Turgat Pass a few miles south of the lake—which crest seems to be now generally adopted as the Russian frontier—to be about 12,800 feet above the level of the sea, and he observed that, although there was no immediate drainage from the lake itself, it formed the watershed at this point between the east and west, the Aksu and the Arpa, which rise in the same basin as the lake between the two extreme ranges of the Thian-shan, flowing respectively, the one eastward into Turkistan, and the other westward, to join the Naryn or Upper Jaxartes.

On returning to Kashgar from this very interesting trip, Colonel Gordon despatched a party, under command of Captain Biddulph, to the eastward, on the road to Aksu. Captain Biddulph travelled for one stage between the Kizil and the streams of Yapchan, and supplies some important information with regard to the nomenclature of these rivers. He ascertained, indeed, that the main river above Yapchan actually bore the name of Yaman-yar, which had been hitherto supposed to be an invention of the fictitious German Baron, and also that the largest of the channels into which the Yaman-yar was divided was entitled Derbuchek, as given by the Baron in a more correct form than the Telwachook of Mr. Shaw. After passing Fyzabad, at 35 miles from Kashgar, and Kizil Arvat, at 46 miles, all habitation ceased, and the remainder of the road to Maralbashi, about 100 miles, lay through the thick jungle which lined the banks of the Kizil River. Near Maralbashi, which is placed in the published maps very much to the south of its true position, Captain Biddulph observed an isolated basaltic rock, with a treble peak, rising 2500 feet above the plain. It is a very remarkable natural object, and, as was to be expected, is invested with a holy character. The Yarkund River passes by Aksah, about 32 miles south-west of Maralbashi; but its further course to the eastward was not ascertained. Charwagh, indeed, one stage beyond Maralbashi (also called Burchuk), on the Aksu road, was the farthest point to the eastward which the party reached.

But by far the most important of the subsidiary expeditions, which have so nobly illustrated Mr. Forsyth's Mission, and which recal the old geographical triumphs of Elphinstone and Malcolm, has been Colonel Gordon's exploration of the Pamir Steppe. The party left Kashgar on March 17, and travelling by Yengi Hissar and Sir-i-kol

(Sarik Kúl), reached Kilá Penja at the confluence of the two main arms of the Oxus on the 13th of April. They had hoped to have been permitted to have continued their return journey to India via Cabul, either crossing the range from Badakhshan into the Chitral valley, or making the détour of the Bamian Pass ; but the state of Afghanistan, where civil war has broken out and threatens to lead to serious disorder, created an insuperable difficulty, and they were accordingly, by the last accounts, preparing to recross the Pamir to Tash-kurghan, and so on to Yarkund, from whence they would follow in Mr. Forsyth's wake to Leh and Cashmire.

As the Pamir has been lately traversed by a number of native explorers, whose various routes and notes have been sifted and methodized by Colonel Yule, it cannot be expected that any new physical features of importance should have been discovered by Colonel Gordon's party ; but the labours of these officers have been most valuable in verifying the native accounts in some instances, and in disproving them in others, and more especially in obtaining a correct view of the general orography and hydrography of the region. It appears that a stream does actually flow both from the west end and the east end of the lake in lesser Pamir, usually called Barket Yassín ; the former stream, as was known before, joining the Sirhad or southern arm of the Penja, while the eastern stream unites with the Aktash water, and then, turning abruptly, flows northwest through the greater Pamir till it joins an effluent from the Kara-kul Lake and forms the considerable river of Murghabi, which, entering Shignan at Barpenj, passes through the entire length of that valley (identified by Colonel Yule with the "Vallis Comedorum"), and debouches into the Oxus at Wamir, five stages below Kilá Penja. A very valuable result of this determination of the course of the Karakul branch of the Oxus is, that it proves the Barket Yassin, in the lesser Pamir, to be the highest point in the steppe, since the stream which flows out of that lake crosses the whole extent of the greater Pamir in its onward course to Shignan. Colonel Gordon further determined that the Kizil-yurt Plain was the true watershed between the east and west ; the Turkestan river system being fed by the drainage of the hills which buttress this plateau, while the numerous lakes and streams, which are found on the table-land, invariably run off westward to the Oxus. The frontier of Wakhan was also found, as stated by Abdul Majid, to extend over the great Pamir Steppe as far as the Murghabi River, where it marched with Kokand, so that, in theory at least, the territories of

our ally, the Ameer of Cabul, are conterminous in this quarter with a region dependent upon Russia.

We must await the arrival of Mr. Forsyth's detailed report before attempting to resolve other obscurities which still attach to the lower course of the Oxus in its passage through Roshan and Darwuz, before it turns south and debouches in the plain country of Badakhshan.

SOUTH AMERICA.—The interest of South American exploration has for some time centered chiefly in the efforts made by the Peruvian Government to obtain an accurate knowledge of the courses of the many tributaries of the Amazons flowing through their territory, especially with regard to their navigability and the economic uses that can be made of them. The progress of these surveys has been briefly recorded from time to time by my predecessors, and I may now add that an excellent summary, from the pen of Lieutenant Juan Salaverry, of the Peruvian Navy, was published in the October number of 'Ocean Highways.' According to the latest accounts, Admiral Tucker, under whose direction these fluvial surveys have been made, submitted to the Peruvian Government, last December, a report of his proceedings up to that date. Two steamers had been engaged during the latter part of 1873 in surveying the main stream of the Marañon down to the Brazilian frontier, and the northern tributaries, Morona, Pastaza, Potro, and Tigre. The great southern affluent, the Huallaga, had also been submitted to a more accurate exploration than had hitherto been undertaken; all the chief points being determined astronomically, the country along the banks examined with regard to its adaptability for settlement, and the furthest point of steam-navigation ascertained. Whilst active work is thus continued in the eastern portion of the Republic, the veteran geographer, our Honorary Corresponding Member, Don Antonio Raimondy, has exchanged his labours in the field for the not less useful toil of elaborating the results of his researches in a general work on the geography and products of Peru, for the preparation of which the Government has made a liberal grant of money.

Further south, I may make a passing allusion to the journey of our Associate, Captain Musters, and Mr. Hegan, who left England last winter with the intention of proceeding from Buenos Ayres, by way of the upper waters of the Paraguay and its tributaries, to Sucre, in Bolivia. The Council provided Mr. Hegan with a set of instruments for determining positions and heights, and it is hoped that some addition to our knowledge of this part of the continent may

result from the undertaking. I have a letter from Mr. Musten dated from Sucre in Bolivia, and the accounts he gives of his route show that we may expect from him matter of much interest regarding yet unexplored portions of Central South America.

According to the latest accounts, our Associate, Mr. Keith Johnston, who quitted the service of the Society at the end of last year to join a Scientific Commission organised by the Paraguayan Minister in London, to explore Paraguay, had found, on his arrival, the country so distracted by revolutionary movements, that the Commission was dissolved before it had an opportunity of commencing its labours. Resolved, however, not to return home without accomplishing some exploration, Mr. Johnston had offered his services to General Vedia, commander of the Argentine forces in the Gran Chaco, to undertake a survey of the little-known region between the Argentine post of Villa Occidental and Salta, and was in daily expectation of orders to proceed with the work.

AUSTRALIA.—The chief event of the year in Australian geography is the bold and hazardous journey performed by Colonel P. Egerton Warburton, and his party of fourteen men, across the unknown western interior of Australia, from a station on the line of Overland Telegraph and Nickol Bay. For the successful carrying out of this undertaking the Council of our Society unanimously decreed him one of the Royal Medals of the year; and the details of the journey, so far as they have yet reached us, show how well this reward is deserved. Colonel Warburton started with his party, having a number of camels as their beasts of burthen, from Alice Springs, near Central Mount Stuart, on the 15th April, 1873, with the object of reaching the shores of the Indian Ocean and ascertaining the nature and resources of the previously unknown intermediate country. According to the brief account given on his arrival at Adelaide by Colonel Warburton, his course at first lay along the northern face of the M'Donnell Ranges, through a country which appeared to be well watered in ordinary seasons, and offered no great difficulties. The valleys between the parallel hilly ridges were fertile; but when the expedition had got so far westward as to be outside of the limits of the range, it fell in with very bad country—arid and barren, and covered with *spinifex* or porcupine bush, that constant sign of a barren soil throughout the greater part of Australia. As the party continued their toilsome way westward the appearance of the country became worse and worse; lines of sand-ridges presented themselves without any signs of surface water. Their

sufferings from thirst were at length relieved by the discovery of water, through the sharp sight and intelligence of a native belonging to the party. It was, however, very limited in quantity, and beyond it, towards the west, the aridity of the country became worse than ever. "Not a desert," as Colonel Warburton expresses it, "because not utterly destitute of vegetation. Rain sometimes fell, as testified by the scrub, but no surface water remained." The ascent and descent of the sand-ridges overtaxed the strength of the camels, and it was found prudent to march only in the coolness of the night. After some weeks of this kind of travelling, hunger began to assail the party, and one after another of the camels had to be slaughtered to keep themselves alive. At length, whilst the leader was prostrated by illness, and craved to be left behind to die, the remainder of the party strapped him to the back of a camel and made a push for the Oakover River, a tributary of the De Grey, near which were some outlying stations of West Australian colonists. Two of the men were sent on to the nearest station for succour, and returned, after an absence of sixteen or seventeen days, with food and horses, supplied by Messrs. Grant, Harper, and Anderson, of the De Grey River station. Without this timely aid the whole party must have perished. Intelligence of their arrival quickly reached the Government at Swan River, who had for some months expected their arrival at some of the frontier settlements, and a vessel was sent to Nickol Bay to bring them to the capital, whence they departed soon after for Adelaide, reaching that place in April, twelve months after their departure from Alice Springs. Great praise has been accorded by Colonel Warburton to the authorities of Western Australia for the cordial aid and hospitality rendered to the heroic band; and at Fremantle and Perth triumphal arches were erected in their honour. The arrival of Colonel Warburton at Adelaide was also celebrated by a public banquet on a large scale. I ought not to omit to record the fact that the cost of this important enterprise was sustained by two private colonists, the Hon. T. Elder and Captain Hughes.

The contemporaneous expedition of Mr. Gosse, dispatched by the South Australian Government from a position on the Overland Telegraph line south of the starting point of Colonel Warburton, although not successful in crossing to the western settlements, reached the shores of the Great Salt Lake in the interior, which had been discovered a short time previously by Mr. Giles, and named by him Lake Amadeus. From this point Mr. Gosse was obliged to return.

Of expeditions in other parts of Australia, space only permits me to mention that of Mr. W. Hann, in Northern Queensland, who, during the months from June to November, 1863, explored the difficult country along the head waters of the Lynd, Mitchell and Bloomfield rivers, and reached Princess Charlotte's Bay.

NEW GUINEA.—An expedition which has excited much interest among geographers and naturalists is that of M. Miklukho Maklay, a Russian *savant*, to the north-eastern coast of New Guinea. After passing a year on that island, in Astrolabe Bay, this traveller visited the Philippine Islands and Hong-Kong, proceeding thence to Batavia, where he stayed for a time with the Dutch Governor-General at Büitenzorg, in order to elaborate the materials he had collected in New Guinea. Notwithstanding the perils and hardships undergone during his first expedition, M. Miklukho Maklay proposed visiting New Guinea a second time, and, according to the last letters received from him, intended leaving the island of Java at the end of 1873. His intention then was to visit, and reside for some time in, Triton Bay.

M. Miklukho Maklay has already communicated the chief results of his anthropological observations to the Academician Baer at Dorpat. In the 'Natuurkundig Tijdschrift voor Nederlandish Indie' for 1873, there appeared a very instructive article by M. Miklukho Maklay, under the title "Anthropologische Bemerkung über die Papuas der Maclay-Küste in New Guinea."

More rich in geographical results has been the exploring voyage of H.M.S. *Basilisk*, under the command of Captain Moresby, along the south-eastern coast of this great island. Captain Moresby relates in his letter to Sir Henry Rawlinson, giving an account of his remarkable discoveries, that the *Basilisk*, having accomplished sooner than he anticipated the mission with which it was charged, viz., the suppression of the illegal employment of Polynesian natives by the pearl shellers in Torres Straits, he employed his spare time in attempting to complete the unfinished survey of Captain Owen Stanley on this coast. The result was to find the eastern termination of the land very different in configuration from what it had been represented on maps, and further, the discovery of a magnificent harbour on the south-east coast. I need not dwell further on the details of this important voyage, which have already been published in our 'Proceedings,' and will soon appear in a more complete form in our 'Journal,' but I cannot refrain from alluding to the agreeable picture drawn by Captain Moresby of the native in-

habitants whom he found at this eastern extremity of New Guinea, and who appear to be totally different in race, as they are in the mildness of their manners and in their hospitable treatment of visitors, from the hostile Papuans of the western portion of the island. Instead of the uncompromising hostility with which strangers attempting to land have been generally met in other portions of the island, Captain Moresby says that, although on all possible occasions he gave his crew liberty to go on shore and mix freely with the natives, perfect good feeling and confidence prevailed on both sides.

This contrast between the races of the east and west has also been remarked on by the Rev. Wyatt Gill, who communicated to the Society early in the Session an interesting account of his three visits to the mainland of New Guinea from the Mission Stations in the islands of Torres Straits. Mr. Gill was fortunate enough to see the natives of both races on different parts of the coast, and to ascertain, by inquiries of the resident missionaries, the line of separation between them, which on the south coast is the Manumanu River. All the coast natives west of this river belong to the black or negrillo race, while east of this a light copper-coloured race, apparently of Malay descent, occupies the country. It was these latter with whom Captain Moresby had to deal, and he speaks in high terms of their docile disposition and their industry. Since these papers were read a strong reinforcement has left this country for the Mission Stations in Torres Straits, and a small coasting steamer, the gift of Miss Baxter, has been sent out to enable the missionary parties to explore thoroughly the south-eastern coast and ascend the rivers, with a view to adding to our knowledge of this wonderful country, as well as of selecting sites suitable for mission stations.

Whilst English explorers have been thus profitably engaged at the eastern end of New Guinea, more than one party of *savans* of other nations have been doing good work at the western extremity. Thus Dr. Meyer, a German naturalist, known for his former researches in the island of Celebes, has succeeded in penetrating a considerable distance into the interior, and is said to have crossed the isthmus between Great Geelvink Bay and McCluer Inlet, but we have not at present seen any detailed account of the proceedings of this enterprising traveller. A more prolonged investigation of the western peninsula and of the neighbouring islands, especially the Aru Group, has been made by the Italian naturalist, Dr. Beccari,

and his companion, Signor D'Albertis, the latter of whom has lately returned to Europe, bringing with him the valuable collections in almost all branches of natural history accumulated by their united labours, the chief part of which, I believe, is destined for the museum of Genoa, now under the management of the Marquis Giacomo Doria, himself an accomplished naturalist and a former fellow-traveller of Dr. Beccari. Beccari and D'Albertis explored together in 1872 the western coast of the peninsula near Dorey, and the mountainous country of the Arfak and Atam some distance in the interior; and Dr. Beccari in the year following devoted many months to the examination of the Aru and Ké islands, of the former of which he has sent home a sketch-map, furnishing a welcome contribution to our knowledge of this little-known group. Other Italian explorers are Signor G. E. Cerutti, who made a survey, in 1870, of the straits between New Guinea and the island of Salwatty; Commandante Lovers di Maria, of the corvette *Vettor Pisani*, who, in 1872 and 1873, further examined the same straits and the channels of the Ké and Aru islands. In connection with these important explorations by Italian geographers and naturalists, I ought to mention that the results have been admirably recorded and illustrated by excellent maps in the periodical work entitled 'Cosmos,' conducted by our able Honorary Associate, Signor Guido Cora, of Turin.

AFRICA.—Africa has occupied by far the greater part of the attention of the Society during the past session, and on every side visible progress has been made towards filling up those large blank spaces on the map, which are still sources of such interest to the geographer and such a stimulus to the exertions of the enterprising traveller.

On the Western Coast, if the expedition against the Ashantees has not added much to our geographical records, it has materially quickened the interest attaching both to the Coast country and the Niger Valley. It has directed attention to quarters which are still unexplored, and effectually tended to lessen both the real and imaginary dangers of further exploration, besides leading to the publication of much information regarding the country.

The same may be said of what we have received from Sir Samuel Baker regarding his most adventurous expedition. The main parts of what he had done and discovered had been made known to us before my predecessor last addressed you, and since then you have had the great pleasure of welcoming Sir Samuel and the heroic partner of all his wanderings, and of hearing from his own lips, in

the lectures and addresses with which he has so liberally favoured us, and which are duly recorded in our journals, as much of the detailed history of his achievements as it would be possible to communicate without the publication of his work, which is so anxiously expected by all of us. Though the direct geographical results may be generally confined to the correct ascertainment of points previously visited by him, and the filling up by his accomplished relation and fellow-traveller, Lieutenant Baker, of many blanks in parts of the country which Sir Samuel had discovered in former journeys, most important service has been done to geography by proving the accessibility of regions which, a few years ago, were practically closed to European travellers; and we may every year hope for fresh contributions from those who are following in the path so energetically and successfully opened by Sir Samuel. The transmission by him of a letter addressed to Dr. Livingstone, which was forwarded across the Nile Valley, and reached Lieutenant Cameron at Unyanyembe, is in itself a fact of no small importance, geographically, as indicating the feasibility of transit by routes which had previously required all the energy of Burton, and Speke and Grant to traverse.

Yet more important is the fact which Colonel Grant has just learnt from a letter he has received from Colonel Gordon, that Lieutenant Cameron's reply to Sir Samuel's letter, and addressed to Sir Samuel at Gondokoro, had safely reached Colonel Gordon. It is thus clear that the King of Uganda, with whom Colonel Gordon's predecessor had established friendly relations, is able to insure the conveyance of letters from the outposts of the Khedive of Egypt to those of the Sultan of Zanzibar.

It is, moreover, clear from Colonel Gordon's letters that the difficulties in the way of reaching the lakes from Egypt have been greatly reduced since Sir Samuel's first most adventurous journey.

Colonel Gordon writes from Gondokoro 16th April, and Khartoum 4th May. His letter reached London 17th June—one day short of two months from Gondokoro. He had left Cairo 21st February, and Suez the 22nd; arrived at Suakin the 26th, and left 28th; arrived at Berber 8th March, and left the 9th; thus reaching Khartoum on the 13th March, or 18 days from Suez.

The "Sud," the great floating vegetable barrier, which so effectually closed the navigation of the river when Baker went up, had been cut through as Baker had suggested, so the route to Gondokoro was open.

Colonel Gordon left Khartoum the 21st March, and reached Gondokoro on the 10th April. In descending again from Gondokoro, he reached Kytch ( $5^{\circ} 30' N.$  lat.) on the 10th April, and Khartoum on the 4th May—11 days from Gondokoro : but he believes it could be done in 8 days. He expects to have vessels on Lake Albert N'yanza in November.

In another letter, dated Khartoum 4th May, Colonel Gordon states that he had seen an embassy from King M'tesa of Uganda at Gondokoro, where they arrived four days previous to himself. They consisted of twelve Waganda and one Arab, and brought presents; amongst which was a cap worked by M'tesa's own hands. Gordon's baggage had not arrived, so he could make no suitable return; but he sent back all the slaves, his own cap, and some pictures, to M'tesa.

The Waganda witnessed Gordon's landing in state from his steamer at Gondokoro; they were shown the engine and furnace, and also had a sail in the steamer. On inspecting the sketches of Waganda in Speke's volume of the 'Discovery of the Sources of the Nile,' they were delighted when they recognised their own king, his mother, and other sketches with which they were familiar. Gordon tore out all the pictures and sent them to M'tesa.

The Waganda also brought two letters from Lieutenant Cameron, dated August and November last. These gave accounts of Dr. Livingstone's body having arrived, of Dillon's death, and Murphy's resignation. The Waganda told Gordon that Cameron intended to go by Karagweh to the north, and Gordon gave instructions that every assistance should be rendered to Cameron, should he reach Uganda. The King of Uganda sent for a male and female donkey, a man who would teach him to read the Koran, a writer, and a barber to shave him.

The great German Expedition to the countries north of the Congo has been fairly started; and their proceedings are regularly recorded in a publication issued by the German African Society, of which seven or eight numbers have already appeared.

The Expedition under Lieutenant Grandy, which was equipped by Mr. James Young, with a view to meeting Livingstone, should he have turned his steps westward, has hitherto not been attended with the results hoped for. Nor has the Expedition under Lieutenant Cameron as yet added much to our geographical knowledge, though it was effectual in affording to the followers of Livingstone useful aid at a critical part of their journey homeward with the body of

the great traveller. Lieutenant Cameron, when we last heard of him, had reached Ujiji, and, finding that he should not be able to travel west of the lake for some months, was preparing to explore by boat the south-western shores. The losses he had sustained by the death of his two promising companions, Dr. Dillon and young Mr. Moffat, and by the invaliding of Lieutenant Murphy, will be fresh in your recollection; but, from what I know of his pluck and determination, I entertain hopes of his yet achieving distinction and adding to our information regarding the lake-region by his single-handed exertions, should his health enable him to prosecute his journey.

Many gaps, of greater or less extent, have been filled up on the eastern side by Dr. Kirk, Captain Elton, Mr. St. Vincent Erskine, Père Horner, and others.

One of the great geographical events of the year has been the publication of Dr. Schweinfürth's Travels, the valuable results of which were glanced at in describing the grounds for conferring on that accomplished traveller the highest honour we have it in our power to bestow. The enormous amount of valuable information on so many subjects, which he has collected, assures me that in his future travels he will record those astronomical determinations of distances, which alone are wanting to render his work one of the most complete, as it is among the most suggestive of modern travels.

But the main interest of the year centres in the most important contribution to geographical knowledge which we have received for many years past, in the journals of our own Livingstone. Nothing can exceed the minuteness and careful accuracy, as far as his means went, of the notes kept by Dr. Livingstone. No less than 17 pocket rough-note books, filled with careful memoranda of each day's journey, were found among his papers; and whenever he made a long halt, he appears carefully to have written out his journal in a connected narrative, and to have plotted on map-paper every portion of his track. All the voluminous data thus collected, appear, as far as can be ascertained, to have been recovered, and are now in the hands of his eldest son, Mr. T. S. Livingstone, who is preparing them for publication; and a very cursory examination of their contents shows that they are full of the most valuable geographical information regarding the whole region between the third and twelfth degrees of south latitude, and the twenty-fifth and thirty-fifth degrees of east longitude. It is more than pro-

bable that when the whole is before us, and fitted in with the contributions of other recent travellers, we may find that much more has been filled up in the blank spaces of the map of Africa than we as yet are aware of. I have noticed very briefly, in the short sketch of the great traveller's labours, the salient points in his later contributions to geographical science, and we await the fuller information we hope for in his published journals.

*Conclusion.*—Such is a brief sketch of our proceedings during the past year. It gives, I hope, some ground for confidence in the inherent vitality of this great Society; but more than this, it is, I trust, one of the many satisfactory circumstances to which we may look as proofs of national vitality. It shows a substantial taste among large masses of our countrymen for all that pertains to geography; for exploration, however arduous; for scientific investigation, however intricate; and for faithful, honest record of failures as well as of successes. The taste for such labours cannot co-exist with a worn-out national nature, or with the causes of national decay. We all know how much this great Society owes to Royal patronage, and to the life-long labours of Presidents like Sir Roderick Murchison, to Associates and travellers like Livingstone; but Princes may found and foster with Royal bounty societies for the promotion of such studies, philosophers may instruct them, great travellers may make them the depositaries of their discoveries, still the society cannot flourish, as ours has done, unless there be in the national constitution the vital springs of active national life; and from the day when Prince Henry founded the first Geographical Society on a weather-beaten promontory of Portugal, up to this moment, we find that such societies have flourished as the nation was vigorous and growing. And now, when this Royal Geographical Society of ours, approaching the first half-century of its existence, boasts itself as the parent of 33 similar institutions which have been founded in all parts of the world, since the Royal Geographical Society led the way, we find that everywhere they prosper as the nation prospers, and where the nation is weak or effete they are sure to languish. But while this vigorous vitality gives to our Society much substantial cause for satisfaction, let us look well to our laurels. Great nations, like France, Italy, and America, like Germany and Russia, have, since our Society was founded—44 years ago—established Societies of their own, whose activity gives to them the same evidence of national enterprise and

life as ours : and if we slacken our pace, either from indolence or self-complacency, we may be passed in the race.

It seems to me that the Society may well turn its attention in two directions. First, let us look to the qualifications of our travellers. No country possesses in such perfection the best raw material. The strong physical constitution, the buoyant energy (physical as well as mental), the keen power of observation, the good-humoured indifference to opposition and danger—the determination not to be beaten—are more common among our youth, more lasting among our seniors, than in most other races ; but there can be no doubt that this very abundance of natural gifts is apt to give us a dangerous contempt for artificial culture. How often have our working geographers lamented the neglect of systematic training by some of our most enterprising travellers ! How few have imitated Livingstone in his life-long devotion to his own education in all that makes an accurate observer, as well as an active explorer ! How rarely do we see men training themselves as Schweinfürth and Hildebrand have done, through years of preliminary travel and study, with their eye always fixed on some great future enterprise ! It is this which, to my mind, gives its special value to what has been so well undertaken by our associates, Mr. Galton and Mr. Brodrick, in connection with geographical studies in our public schools, and in which, at Dr. Acland's suggestion, we hope to interest our Universities.

But we must also take care that our own Government shall find good reason for supporting us when we have need of State assistance. In other countries the work may be done when you have once interested some great statesman in an enterprise of exploration ; but here, in England, when our great statesmen succeed to office, they are apt to distrust themselves, and are sometimes distrusted by their countrymen, in proportion to the strength of their convictions, or the clearness of their views, when projects of science come to seek assistance from the public treasury. Our Ministers are trustees for the public purse, and, most righteously, jealous guardians of their trust. Every proposal for State assistance is scanned as if it were a plot to rob the Treasury, and to gain their support it is necessary not only to carry with us the verdict of the scientific world, we must also bring to bear on them the convictions of great industrial classes, and the public opinion of the taxpayers. It is the more important to recollect this, because, in many of our great exploring enterprises, I look upon Government co-operation as

worth much more than the grant of public money. Few men are better trained for travel than the scientific branches of our army and navy (the *men*, let me observe, as well as the officers), and personal enterprise can, especially in such arduous tasks as Arctic exploration, compensate for the lack of that strict discipline which is nowhere among us found in such perfection as in our national forces. While, then, we do all that is in our own power to train our travellers, let us relax no effort to carry with us the cordial sympathy of the people and the Government of our country.

We must not separate without recording in an especial manner our obligations to the University of London for the courtesy with which they have continued to allow us the use of this magnificent Hall for the meetings of the Society. The readiness with which this facility, whenever applied for, has been accorded us, is the more gratifying, as I feel assured that a body so careful of the interests confided to their charge, as the Senate of the University, thereby recognise the desire of the Royal Geographical Society to contribute in its own sphere to the sound and thorough education of the great mass of our countrymen.

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